Attachment 1

A Dispersion Modeling Analysis of Downwash from Mirant's Potomac River Power Plant

Mirant Potomac River, LLC
Alexandria, VA

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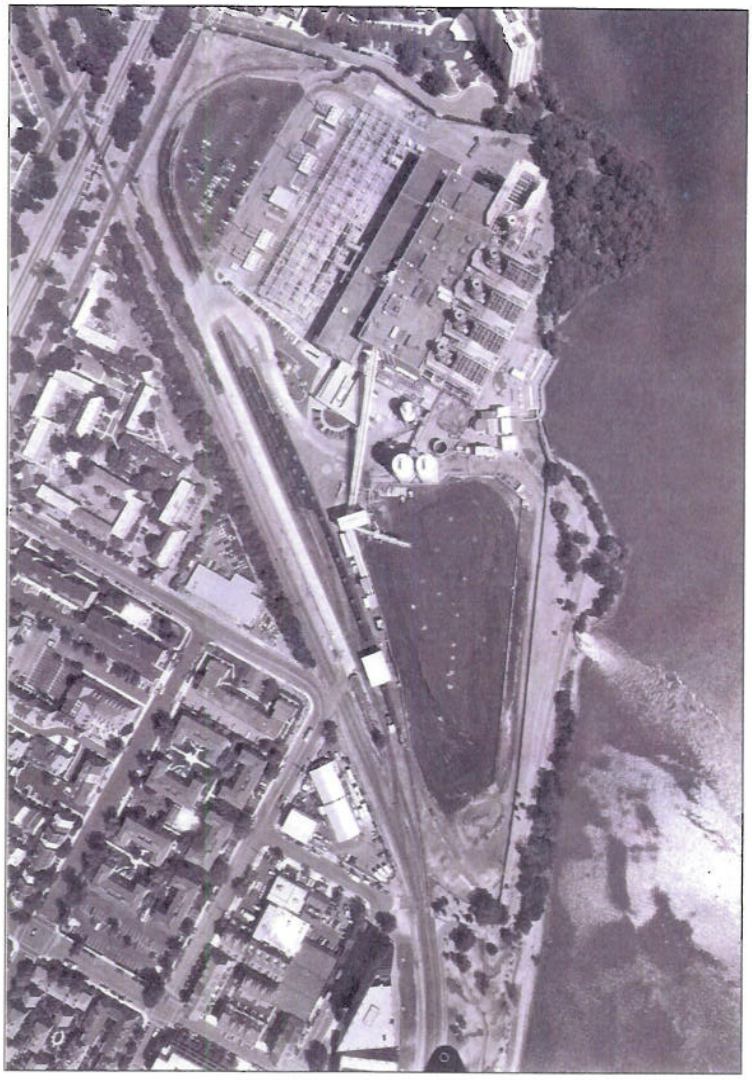

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1.0 INTRODUCTION

1.1 Project Overview

Mirant Potomac River, LLC (Mirant) submitted a modeling protocol on October 13, 2004 pursuant to an Order By Consent issued by the Commonwealth of Virginia, State Air Pollution Control Board. The Protocol described MIrant's proposed refined modeling analysis to assess the effect of aerodynamic downwash from the facility on ambient concentrations of sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO) and particulate matter with an aerodynamic diameter less than or equal to 10 micrometers (PM_{10}). The Protocol described the methods to be used to assess compliance with the National Ambient Air Quality Standards for these pollutants. In addition, the Protocol described the methods to be used to assess the effect of downwash from the facility on ambient concentrations of mercury for comparison to the applicable Standards of Performance for Toxic Pollutants set forth in VAC 5-60-200, et. Seq., in the area immediately surrounding the facility. The Order is included in Appendix A of this protocol.

Mirant received written comments, dated February 10, 2005, from Mr. Ken McBee, Modeling Coordinator for the Virginia Department of Environmental Quality, Office of Air Permit Programs. The letter required Mirant to submit a revised protocol within 30 days (March 15, 2005). On March 8, 2005 Mr. McBee granted Mirant a 10-day extension to March 25, 2005 in order to incorporate recently received GIS data from the City of Alexandria. The GIS data contains building height data for high rise apartments for use as flagpole receptors in the modeling.

Mirant submitted a modified protocol on March 24, 2005. Comments on the modified protocol were submitted to Ken McBee of the VADEQ. Mr. McBee issued a letter dated June 17, 2005 stating that the modified protocol satisfies the DEQ's requirements with the exception of several items listed in his letter. This report presents the results of modeling the PRGS according to the modified protocol. The several items listed in Ken McBee's June 17, 2005 letter are addressed in this report. Correspondence is included in Appendix A.

1.2 Report Outline

This document is a modeling report that describes the use of EPA's proposed Guideline model, AERMOD with PRIME (hereafter called AERMOD), to assess downwash from Mirant's Potomac River Generating Station.

Section 2 of this report describes the facility and lists the permitted or maximum emission rates. Section 3 discusses the methods used in conducting the air quality dispersion modeling analysis including the dispersion model selection criteria, the Good Engineering Practice (GEP) stack height and downwash modeling inputs, model receptor locations and meteorological database. Section 4

describes representative ambient background data. Section 5 presents modeling results. Conclusions are presented in Section 6. References are listed in Section 7.

1.3 Basis For Ambient Compliance

Modeled concentrations of criteria pollutants were added to a monitored background concentration and the total was compared to the NAAQS shown in Table 1-1. The monitored background concentration represents the contribution to total air quality from all other sources in the area. Modeled concentrations of mercury were compared to the mercury limits contained in the Standards of Performance for Toxic Pollutants.

Table 1-1 National Ambient Air Quality Standards and Standards of Performance for Toxic Pollutants

Pollutant	Averaging Period	Primary NAAQS ($\mu g/m^3$)	Secondary NAAQS ($\mu g/m^3$)
NO_2	Annual(1)	100	100
SO_2	Annual(1)	80	None
	24-hour(2)	365	None
	3-hour(2)	None	1,300
PM_{10}	Annual(4)	50	50
	24-hour(3,5)	150	150
CO	8-hour(2)	10,305	10,305
	1-hour(2)	40,075	40,075

(1) Not to be exceeded
(2) Not to be exceeded more than once per year
(3) Not to be exceeded more than an average of one day per year over three years
(4) Not to be exceeded by the arithmetic average of the annual arithmetic averages from 3 successive years
(5) Compliance with the 24-hour standard is demonstrated when the 6th highest 24-hour concentration at each receptor, based on 5 years of modeling, is predicted below the standard Source 40 CFR 50

The NAAQS have been developed for various durations of exposure. The short-term (24-hours or less) NAAQS for SO_2 and CO refer to exposure levels not to be exceeded more than once per year. Long-term NAAQS for SO_2 and NO_2 refer to limits that cannot be exceeded for annual exposure. Compliance with the PM_{10} 24-hour and annual standards are statistical, not deterministic. The standards are attained when the expected number of exceedances each year is less than or equal to one. When modeling with a five-year meteorological data set, compliance with the 24-hour standard is demonstrated when the 6th highest 24-hour concentrations at each receptor, based on the 5 year data set, is predicted to be below the standard. Compliance with the annual standard is demonstrated when the arithmetic average of the annual arithmetic average from 3 successive years is predicted to be below the standard at each receptor. PM_{10} was analyzed as a surrogate for $PM_{2.5}$ as per EPA guidance.

The limits for mercury in the Standards of Performance for Toxic Pollutants are not to be exceeded and have been established for the annual and 1-hour averaging periods for mercury vapor. The TLV-TWA

8-hour limit for mercury vapor is equal to 0.025 mg/m^3 (25 µg/m^3). The Virginia Air Code 9VAC5-60-230 states that the annual ambient concentration (from the facility) should not exceed 1/500 of the TLV-TWA (or 0.05 µg/m^3) and the 1-hour concentration from the facility should not exceed 1/20 of the TLV-TWA (1.25 µg/m^3)

1.4 Conservatism of Modeling Results

This analysis was performed to assess compliance with ambient standards. The analysis incorporated several conservative assumptions to ensure that the absolute maximum pollutant concentrations are predicted. Actual maximum pollutant concentrations due to the power plant are likely much lower than the maximum predicted concentrations presented in this report. For example,. modeling assumed that all combustion sources at the power plant are operating at maximum load for the entire year even though the power plant operates about 60% capacity in a typical year. In addition, because Mirant is a significant contributor to existing background concentrations, the addition of existing background concentrations to Mirant's predicted ambient impacts in this analysis has the effect of double counting Mirant's contribution.

Marina Towers, a high rise residential complex, was constructed without considering the effects of pre-existing emissions from the power plant and the building of this structure adjacent to the existing power plant increased the downwash effect. Nevertheless, receptors were placed at all levels of this structure to ensure that maximum air pollutant impacts are identified. Ground-level air pollutant concentrations are predicted to be considerably lower than impacts on the tower.

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2.0 PROJECT DESCRIPTION

The Potomac River Generating Station consists of five bituminous coal-fired electric utility steam generating units. Units #1 and #2 each generate 88 megawatts of electricity. Units #3, #4 and #5 each generate 102 megawatts. The facility is located in Alexandria, VA, approximately 1 mile south of Reagan National Airport. Figure 2-1 depicts the site location.

There are five boiler stacks at the power plant. Flue gases from each boiler exit into the atmosphere through its own stack. Each boiler unit is equipped with hot and cold side electrostatic precipitators for particulate control.

Table 2-1 presents stack parameters and permitted emissions rates for SO_2, NOx and TSP/PM_{10} that were used in the dispersion modeling. The facility does not have limits on CO and mercury emissions. Maximum CO emissions were determined from the facility's continuous emission monitoring (CEMs) system. The maximum 1- and 8-hour CO emission rates for modeling are based on 10% above maximum measured values during calendar year 2004. The maximum 1-hour and annual average mercury emission rates were calculated using emission factors of 7.70 lb/trillion Btu for the 1-hour average and 4.31 lb/trillion Btu for the annual average. These emission factors represent the actual maximum 1-hour and actual annual average emissions for year 1999 as reported for PRGS to EPA in response to their Information Collection Request. The mercury emissions from each unit were calculated by multiplying this emission factor by the maximum capacity in MMBtu/hr of each unit. The result is a lb/hr emission rate for modeling.

Coal is transported to the site by rail. Coal is unloaded to an underground conveyor system, transported to the breaker house, and from there to the boiler building. Coal that is not fed directly to the boiler building is distributed onto a coal pile in the coal storage yard. Coal reclaimed from the yard is dumped onto the same underground conveyor system and routed to the boiler building. Bottom ash from the boilers and fly ash from the precipitators are stored in silos located on the south side of the boiler house. The ash is then loaded into covered trucks and removed from the facility. Tables 2-1 and 2-2 present point source release parameters from the ash silos and release geometry from the fugitive sources on site. Figure 2-2 shows the locations of point and fugitive sources.

Figure 2-1 Mirant Potomac River Generating Station Location

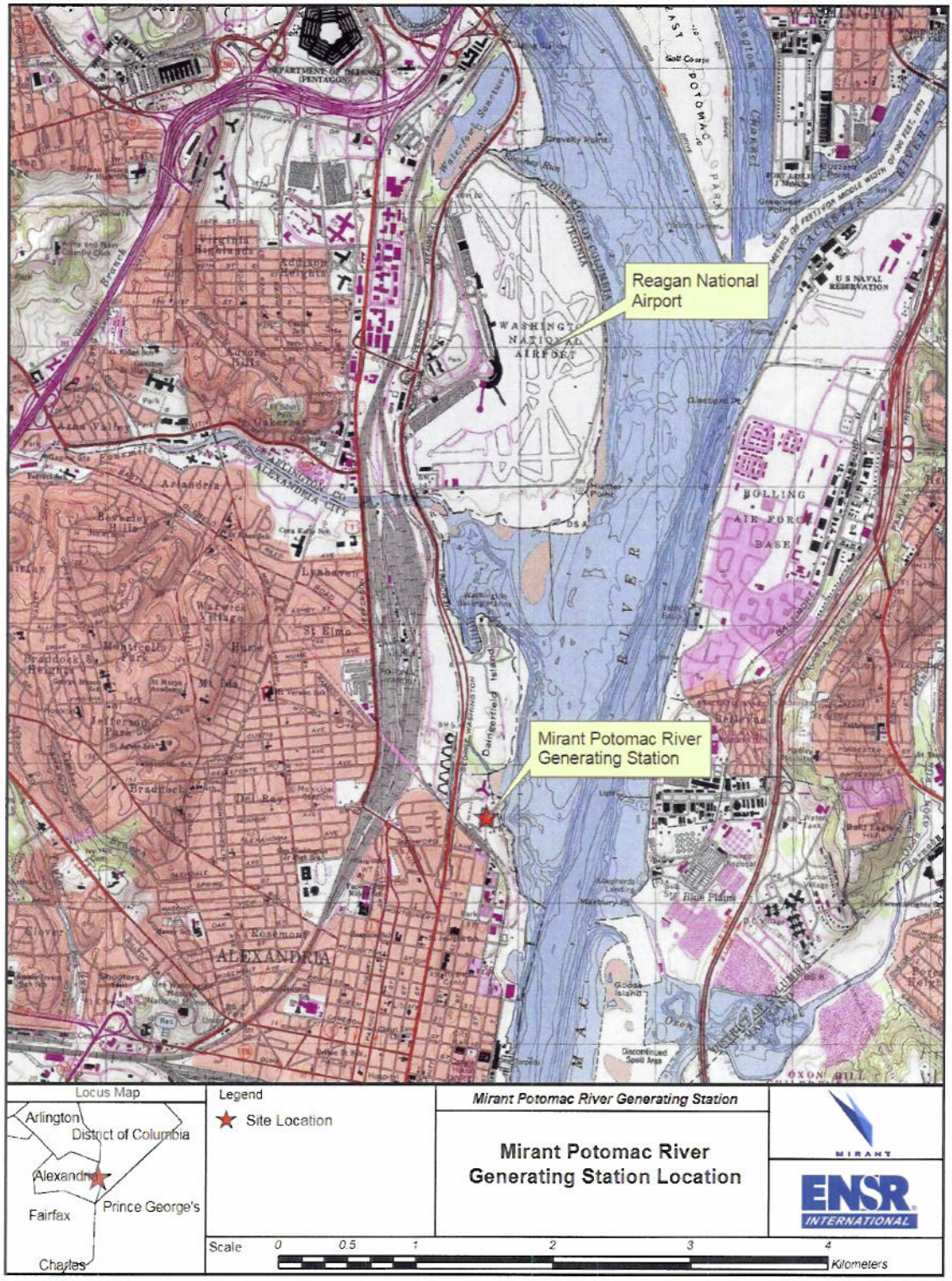


Table 2-1 Point Sources Stacks Parameters and Emissions

Point Source	Heat Input	SO_2		NOx		TSP/PM_{10}		CO			Hg	
	MMBtu/hr	lb/hr[1]	g/sec	lb/hr[2]	g/sec	lb/hr[3]	g/sec	ppmv[4]	lb/hr	g/sec	lb/hr[5]	g/sec
Boiler 1/ Stack 1	1053.0	1600.6	201.7	473.9	59.7	126.4	15.9	680.9	934.2	117.7	8.11E-03	1.022E-03
Boiler 2/ Stack 2	1029.0	1564.1	197.1	463.1	58.3	123.5	15.6	688.6	923.3	116.3	7.92E-03	9.983E-04
Boiler 3/ Stack 3	1018.0	1547.4	195.0	458.1	57.7	122.2	15.4	631.2	837.2	105.5	7.84E-03	9.876E-04
Boiler 4/ Stack 4	1087.0	1652.2	208.2	489.2	61.6	130.4	16.4	677.5	959.6	120.9	8.37E-03	1.055E-03
Boiler 5/ Stack 5	1107.0	1682.6	212.0	498.2	62.8	132.8	16.7	645.9	931.7	117.4	8.52E-03	1.074E-03
Fly Ash Silo	-	-	-	-	-	0.67	0.08	-	-	-	-	-
Fly Ash Silo	-	-	-	-	-	0.67	0.08	-	-	-	-	-
Bottom Ash Silo	-	-	-	-	-	0.93	0.12	-	-	-	-	-

Notes:

Stack diameter = diameter of venturi nozzle in stack.

Modeled stack height = height of top of venturi nozzle (48.2 meters). Actual stack height = 49.1 m.
Original stack design (1947) included these venturi nozzles to increase exit velocity due to FAA height restrictions.

[1] SO_2 emissions calculations: SO_2 (lb/hr) = 1.52K, where K = total heat input (MMBtu/hr) (9 VAC 5-40-930).

[2] NOx emissions calculations: 0.45 lb/MMBtu (annual average) based on Nox RACT limits.

[3] TSP/PM_{10} emissions calculations: 0.12 lb/MMBtu based on 9 VAC 5-40-900. All TSP assumed to be PM_{10}.

[4] CO emissions based on 10% above highest 1-hour CEM measurement during period 1/1/04 - 12/31/04

CO conversion from ppmv to lb/MMBtu: 1 ppmv =0.001303 lb/MMBtu (assumes flue gas dry @ 3% oxygen).

[5] These are 1-hour mercury emissions based on 7. 70 lb/trillion Btu; annual emissions are based on 4.31 lb/trillion Btu.

Table 2-1 Point Sources Stacks Parameters and Emissions (cont.)

Point Source	Height m	Diameter m	Temp Deg K	Velocity m/sec	Base Elevation m	UTM-X[6] m	UTM-Y[6] m
Boiler 1/Stack 1	48.2	2.6	444.3	35.7	10.4	322803.6	4298573.9
Boiler 2/Stack 2	48.2	2.6	455.4	30.2	10.4	322807.3	4298597.6
Boiler 3/Stack 3	48.2	2.4	405.4	30.8	10.4	322811.1	4298621.0
Boiler 4/Stack 4	48.2	2.4	405.4	33.2	10.4	322814.7	4298644.3
Boiler 5/Stack 5	48.2	2.4	405.4	33.8	10.4	322819.0	4298668.0
Fly Ash Silo	33.6	1.0	293.0	0.1	10.4	322796.5	4298489.3
Fly Ash Silo	33.6	1.0	293.0	0.1	10.4	322810.7	4298494.2
Bottom Ash Silo	31.0	1.0	293.0	0.1	10.4	322785.1	4298523.9

[6] Datum: NAD27, UTM Zone 18

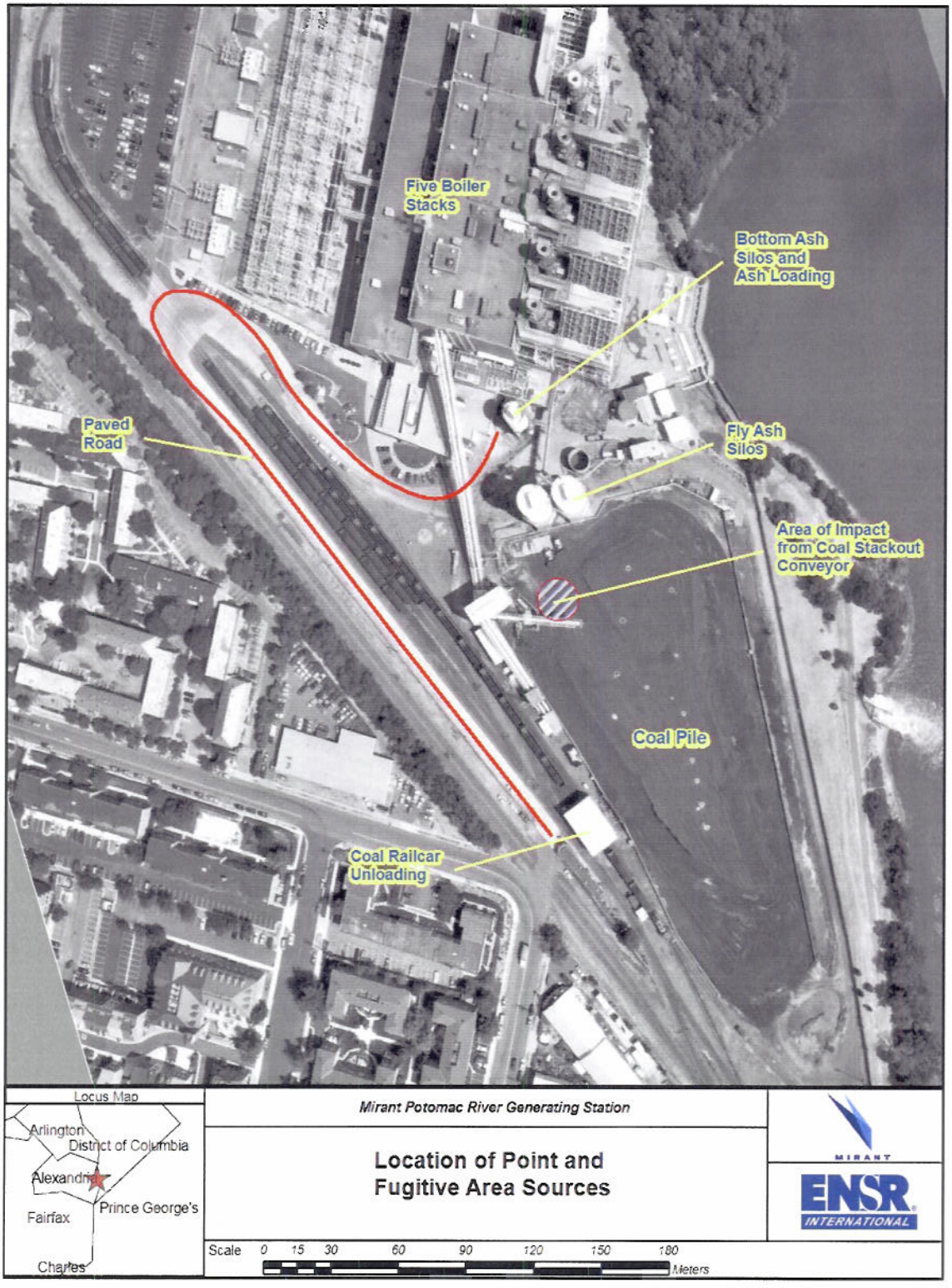
Table 2-2 Area Sources Parameters and Emissions

Area Sources	Size m^2	Height m	PM_{10} Existing Emissions			
			lb/hr	tpy	g/sec	g/sec-m^2
Ash Loader	546	2.0	0.05	0.04	0.006	1.18E-05
Coal Pile Wind Erosion and Dust Suppression	17,679	4.6	0.93	1.12	0.118	6.66E-06
Coal Stackout Conveyor Dust Suppression	263	9.1	0.05	0.20	0.006	2.19E-05
Coal Railcar Unloading Dust Suppression	288	1.0	0.12	0.06	0.016	5.39E-05
Ash trucks on Paved Roads	5,886	1.0	0.60	1.22	0.076	1.29E-05

Notes:

Coal Pile = 4 acres = 17,679 m^2.
Modeled height of coal pile = one half of average pile height = 30 feet x 0.5 = 15 feet (4.6 m).
Modeled height of stackout conveyor dust suppression = average height of coal pile (9.1 m).
Resuspended roadway dust from paved roads: area = 2 x 0.3 miles x 20 feet wide = 5,886 m^2.

Figure 2-2 Point and Fugitive Sources



3.0 DISPERSION MODELING ANALYSIS

3.1 Model Selection

In 1991, the USEPA, in conjunction with the American Meteorological Society (AMS), formed the AMS/USEPA Regulatory Model Improvement Committee (AERMIC). AERMIC's charter was to build upon earlier modeling developments to provide a state-of-the-art dispersion model. The resulting model was AERMOD with PRIME algorithm (hereafter called AERMOD). The PRIME downwash algorithm is technically superior to the downwash algorithm in ISCST3 because the former was developed based on extensive wind tunnel testing that was not available to the developers of ISCST3. The PRIME algorithm allows the model to calculate impacts in the cavity region immediately downwind of a downwashing stack.

Based upon the scientific formulation of AERMOD and its evaluation performance, USEPA is proposing that AERMOD replace ISCST3 and CTDMPLUS as refined dispersion modeling techniques for simple and complex terrain for receptors within 50 km of a modeled source. Since AERMOD does not have limitations in modeling either simple or complex terrain, USEPA is proposing it as a refined technique for all terrain types.

MIRANT has received approval from VADEQ to use AERMOD (Version 04300) for this analysis. AERMET (Version 04300), the meteorological preprocessor for AERMOD, was also used in this modeling. The VADEQ has, in turn, received approval from EPA Region 3 to use AERMOD for this study.

3.2 Good Engineering Practice Stack Height Analysis

A Good Engineering Practice (GEP) stack height analysis was performed based on the current facility design to determine the potential for building-induced aerodynamic downwash for all five boiler stacks. The analysis procedures described in EPA's Guidelines for Determination of Good Engineering Practice Stack Height (EPA, 1985), Stack Height Regulations (40 CFR 51), and current Model Clearinghouse guidance were used. A GEP stack height is defined as the greater of 65 meters (213 feet), measured from the ground elevation of the stack, or the formula height (H_g), as determined from the following equation:

$$H_g = H + 1.5\ L$$

where

H is the height of the nearby structure which maximizes H_g, and

L is the lesser dimension (height or projected width) of the building.

The GEP analysis was conducted using Lakes Environmental's BPIP View (v 4.8.5) software. The controlling structure for determining the GEP formula height for boiler stacks 2 – 5 is Marina Towers. Boiler stack 1, the southernmost stack, is just outside of the influence of Marina Towers. The controlling structure for boiler stack 1 is the boiler building. Figure 3-1 shows the structures that could affect stack downwash. Figure 3-2 shows these structures in three dimensions. Table 3-1 presents the dimensions of these structures from the BPIP output. The GEP height for the boiler stack 1 is 88.2 meters and 97.1 meters for the boiler stacks 2-5. Since the GEP height exceeds the 48.2 meter stack heights, BPIP generated wind direction-specific structure dimensions were input to AERMOD to simulate downwash from each stack. These dimensions are included in Appendix C.

Table 3-1 Summary of GEP Analysis (Units in Meters)

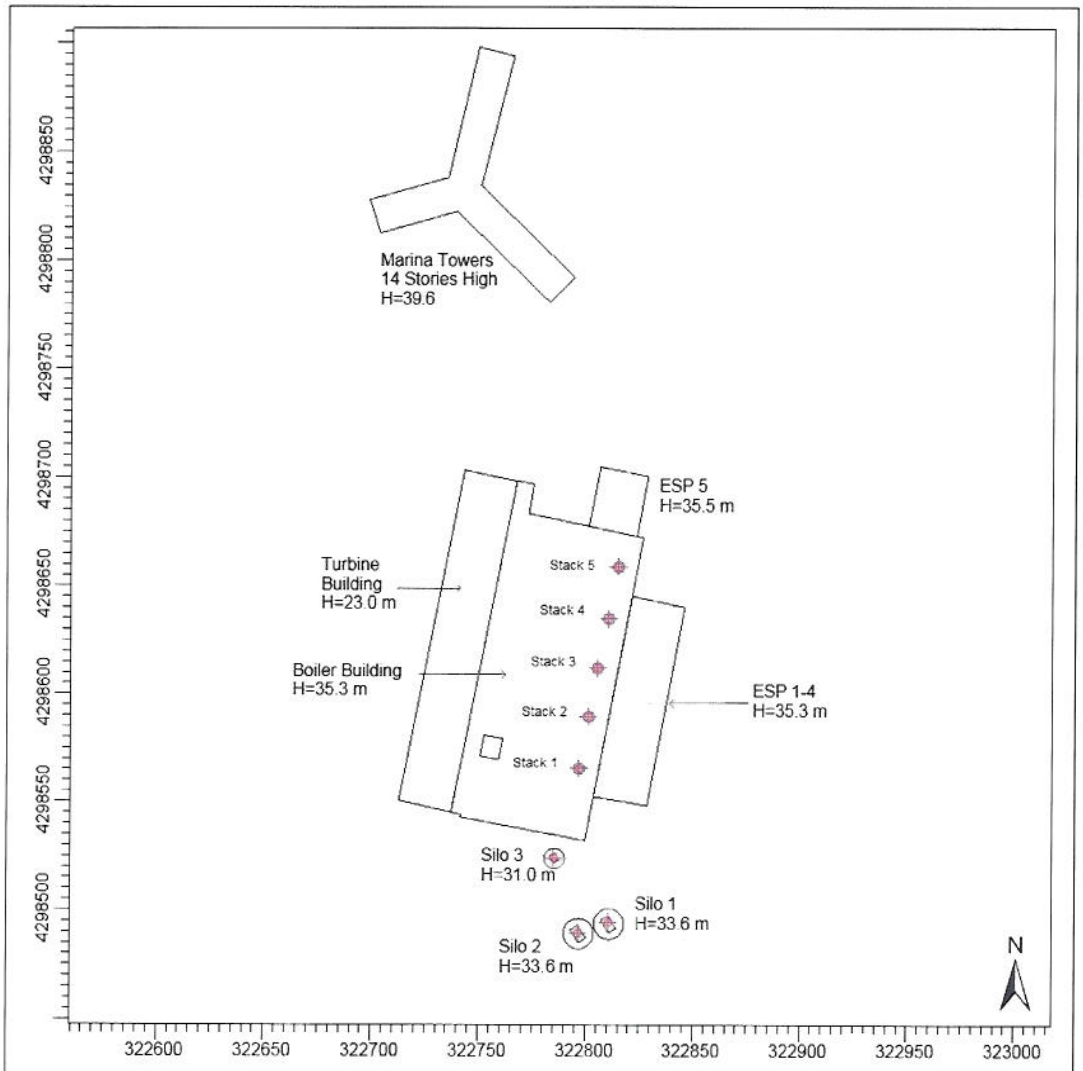
Structure	Height	Length	Width	MPW[(1)]	GEP Formula Height	5L[(2)]	Base Elevation
Boiler Building	35.3	158.0	64.0	170.5	88.2	176.5	10.4
Turbine Building	23.0	156.0	26.0	158.2	57.5	115.0	10.4
ESP 1-4	35.3	94.5	25.0	97.8	88.2	176.5	10.4
ESP 5	35.3	26.0	24.0	35.4	88.2	176.5	10.4
Silo 1	33.6	N/A	13.7	13.7	54.2	68.5	10.4
Silo 2	33.6	N/A	13.7	13.7	54.2	68.5	10.4
Silo 3	31.0	N/A	9.4	9.4	45.1	47.0	10.4
Marina Towers	39.6	N/A	16.3	90.4	97.1	198.0	8.5

(1) Maximum projected width.
(2) 5 times the lesser of the MPW or height is the maximum influence region.

Table 3-2 Summary of GEP Analysis (Units in Meters) (cont.)

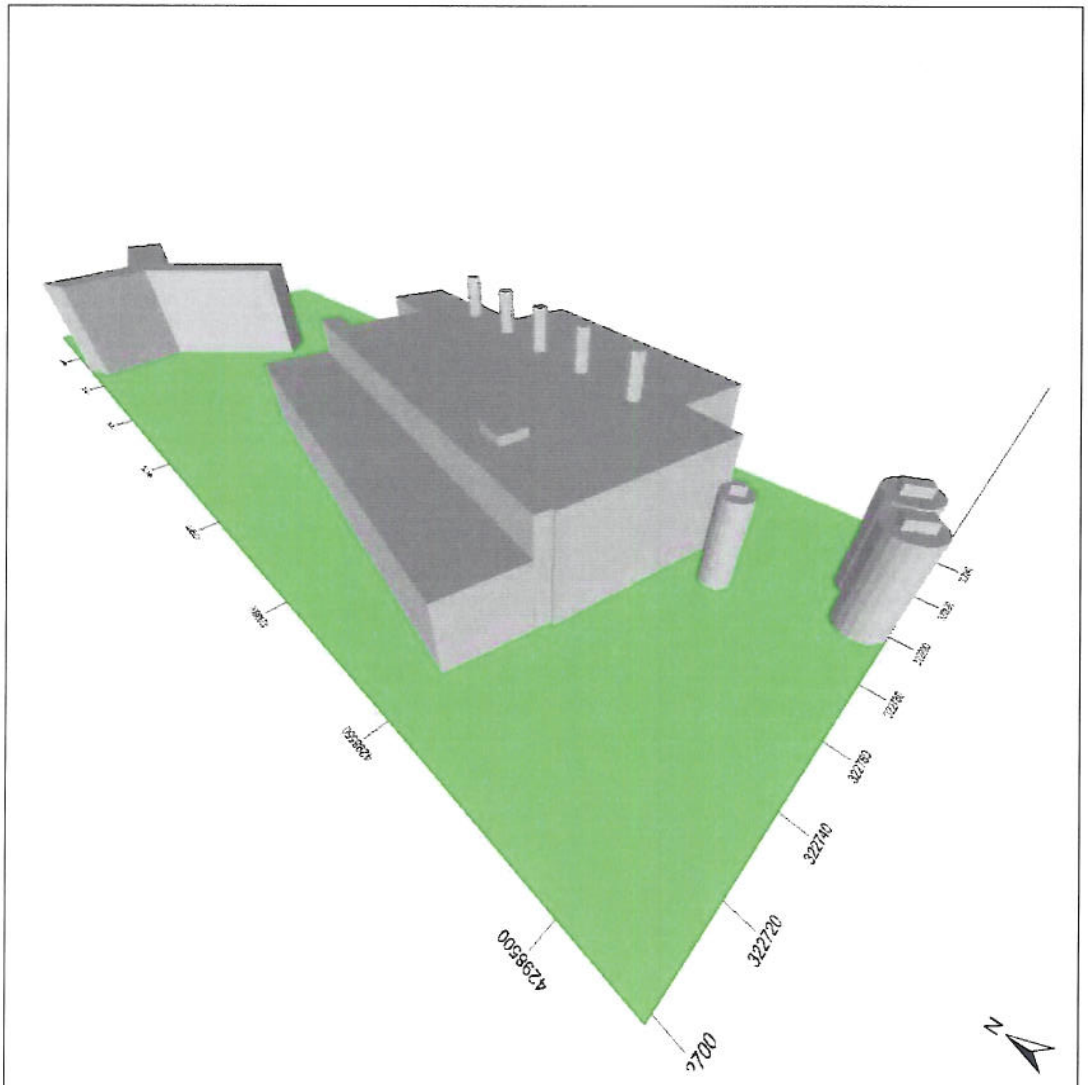
Structure	Distance to the Main Boilers					Stacks Potentially Affected By Downwash				
	1	2	3	4	5	1	2	3	4	5
Boiler Building	0.0	0.0	0.0	0.0	0.0	yes	yes	yes	yes	yes
Turbine Building	55.0	55.0	55.0	55.0	55.0	yes	yes	yes	yes	yes
ESP 1-4	9.6	9.6	9.6	9.6	15.0	yes	yes	yes	yes	yes
ESP 5	111.0	87.3	63.0	40.0	15.7	yes	yes	yes	yes	yes
Silo 1	72.0	96.0	119.0	143.0	167.0	no	no	no	no	no
Silo 2	69.0	92.0	114.0	158.0	161.5	no	no	no	no	no
Silo 3	37.8	62.0	86.0	110.0	134.0	yes	no	no	no	no
Marina Towers	215.0	192.0	170.0	148.0	127.0	no	yes	yes	yes	yes

Figure 3-1 Mirant Potomac River Generating Station Configuration Used for GEP Analysis



BPIP View - Lakes Environmental Software

Figure 3-2 Mirant Potomac River Generating Station Configuration Used for GEP Analysis in 3D



COMMENTS: 3-D View of the Mirant GEP Structures	COMPANY NAME:	
	MODELER:	
	DATE: **3/14/2005**	PROJECT NO.:

3D View - Lakes Environmental Software J:\AQES\Projects\Mirant 10350\Potomac\Lakes\Mirant.bpv

3.3 Building Cavity Analysis

The PRIME downwash algorithm within AERMOD calculates pollutant concentrations within the cavity region. Therefore, no additional analysis (e.g., SCREEN3) is necessary.

3.4 Terrain and Receptor Data

The downwash analysis was conducted out to 5 km. Beyond a distance of approximately 1-2 km effects of downwash cannot be distinguished from ambient impacts of the released effluent that are caused by atmospheric turbulence alone. The receptor grid extends out to 5 km at the request of VADEQ. The receptor grid used in AERMOD was chosen from the USGS maps in accordance with standard EPA procedures. Fenceline receptors were established at 50 m spacing along the property boundary, surrounded by discrete Cartesian receptors placed out to:

0 - 1 km with 100 m spacing.
1 - 3 km with 250 m spacing
3 - 5 km with 500 m spacing

Figures 3-3 and Figure 3-4 show the receptor grid. Maximum impacts were all within 1 km of the facility and were within the area of 100 meter receptor spacing.

Multi-story residential buildings located within approximately 1-2 km from the facility were modeled with flagpole receptors. Due to its proximity, flagpole receptors were placed on upwind and downwind sides of Marina Towers. Table 3-3 presents these buildings.

Table 3-3 Multi-Story Buildings Parameters (Used for Flagpole Receptors)

Multi-Story Building	UTM-X (m) [1]	UTM-Y (m) [1]	# of Stories [2]	Building Height (m) [3]	Story Height (m) [4]
Alexandria House	322630.38	4297725.55	22	64.9	3.0
Carlyle Towers	320703.66	4296828.68	20	46.0	2.3
Carydale East	319579.69	4297276.05	18	48.3	2.7
Port Royal Condo	322652.21	4297815.58	17	46.1	2.7
Braddok Place [5]	321792.71	4298023.30	10	29.9	3.0
The Calvert Apartment	321128.13	4300123.85	15	42.7	2.8
Portals of Alexandria	320730.05	4301226.85	14	44.8	3.2
Marina Towers	322741.09	4298831.15	14	39.6	2.8

[1] Datum: NAD27, UTM Zone 18
[2] The data was obtained from Attachment III of 12/30/04 letter to Ken McBee from City of Alexandria, Department of Transportation and Environmental Services.
[3] Building heights were obtained from the City of Alexandria Department of Planning and Zoning GIS Data.
[4] Flagpole receptors were placed at every story, 3.0 meters apart. Flagpole receptors at the Marina Towers were placed on every section of the building, 2.83 meters apart.
[5] Attachment III lists Meridian Building as 16 stories. The height of this building was not available from the GIS data, therefore we placed flagpole receptors at the neighboring Braddock Place building. Based on the height of the Braddock Place building we assumed that it consists of ten stories.

Figure 3-3 AERMOD Receptor Grid

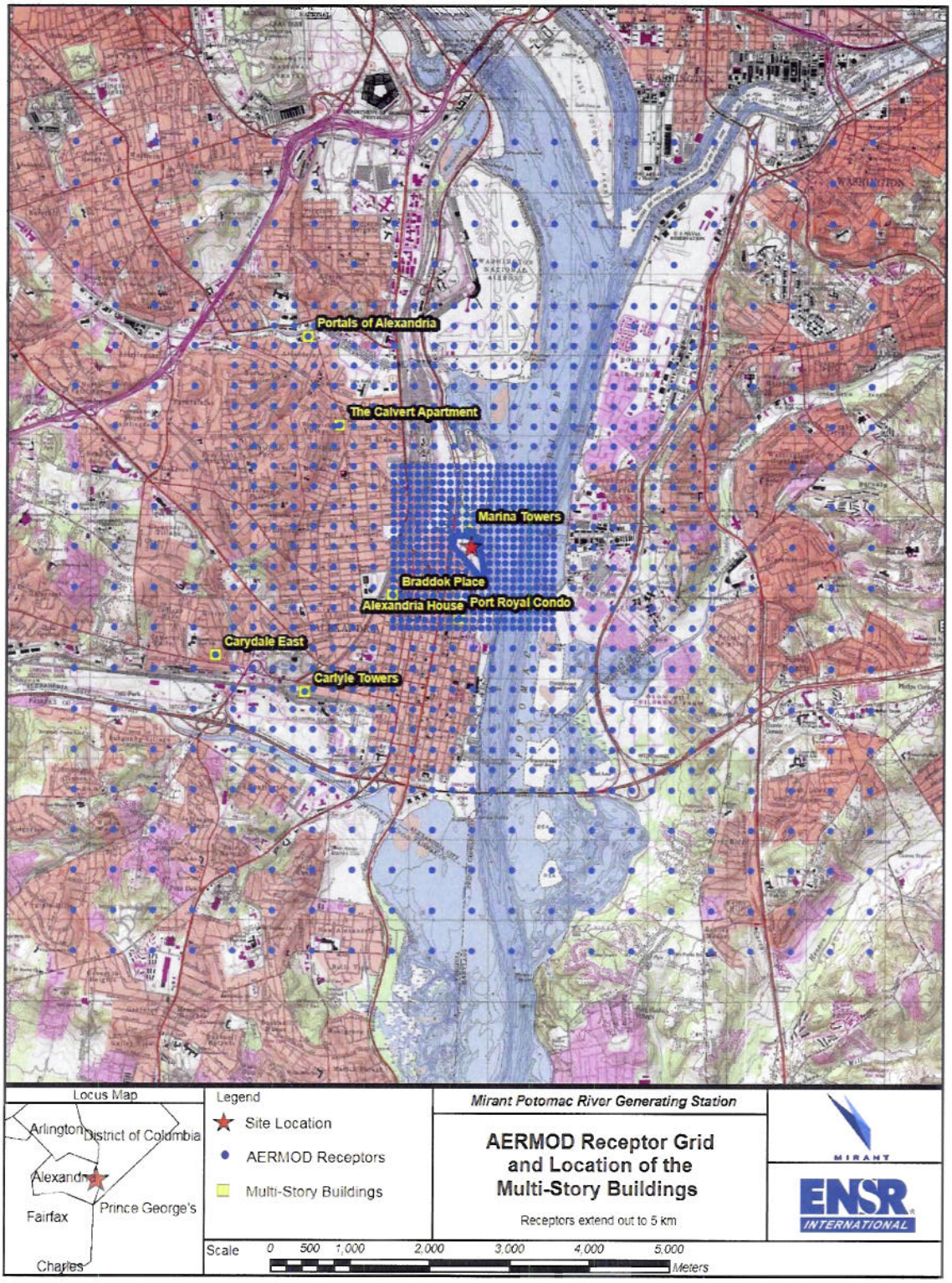


Figure 3-4 AERMOD Receptor Grid and Flagpole Receptors

AERMOD requires each receptor to identify a "height scale" which is defined as the height of a nearby controlling hill. The controlling hill heights and receptor elevations were generated from USGS digital elevation model (DEM) files. Receptor coordinates and elevations are included in the modeling archive.

3.5 Meteorological Data

For refined dispersion modeling, one year of on-site or five years of off-site representative meteorological data are required. For this application, five years of meteorological data was used for input to AERMET, the meteorological preprocessor for AERMOD. Hourly surface meteorological data from the NWS Station at Reagan National Airport, Virginia was used in addition to the upper air meteorological data from the NWS Met Station at Sterling, Virginia to develop the 5-year (2000-2004) AERMET data files (see Figure 3-5).Meteorological data required for the AERMOD model partly consist of hourly values of wind speed, wind direction, and ambient temperature. Since the AERMOD dispersion algorithms are based on atmospheric boundary layer dispersion theory, additional boundary layer parameters are required. These parameters include sensible heat flux, surface friction velocity, convective velocity scale, vertical potential temperature gradient, convective and mechanical mixing heights, Monin-Obukhov length, surface roughness length, Bowen ratio, and albedo. A portion of these boundary layer parameters, as well as hourly wind and temperature profiles of the atmosphere, are estimated using surface parameters and upper air soundings. The base elevation of the primary surface station also is required by AERMOD. The base elevation of the Reagan National Airport was used in AERMOD.

The AERMET meteorological pre-processor (Version 04300) was used to process data required for AERMOD. Site characteristics of the power plant site such as surface roughness, albedo, and Bowen ratio were included in the input control file to AERMET.

3.5.1 Site Characteristics

Table 3-4 shows the land use site characteristics surrounding the Mirant facility. These characteristics were determined by examining a 3-kilometer radius area surrounding the site (centered at the boiler building). The area was then divided into 4 directional sectors for specifying site characteristics (see Figure 3-6 and Figure 3-7).

Table 3-4 Land Use Characteristics Surrounding the Mirant Site

Land-Use Type	Fractional Land-Use			
	Sector 1 (60°-120°)	Sector 2 (120°-180°)	Sector 3 (180°-360°)	Sector 4 (360°-60°)
Water	0.25	0.8	0.05	0.6
Deciduous	0.1	0.05	0.2	0.1
Grassland	0.2	0.05	0.15	0.15
Urban	0.45	0.1	0.6	0.15
Total Land Use	1	1	1	1

Figure 3-5 Meteorological and Air Pollution Monitoring Stations

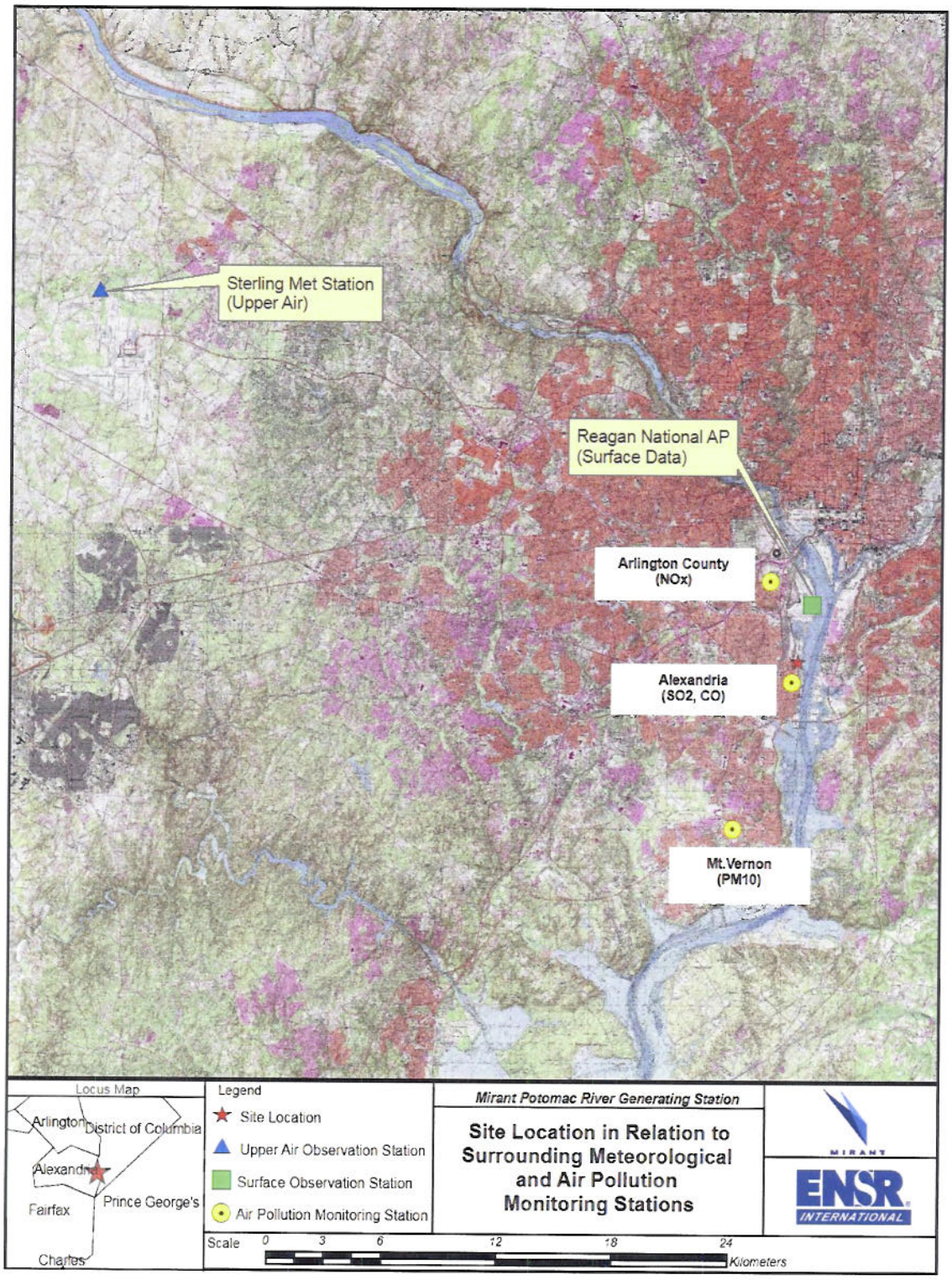


Figure 3-6 Sectors Indicating Land Use at the Mirant Site

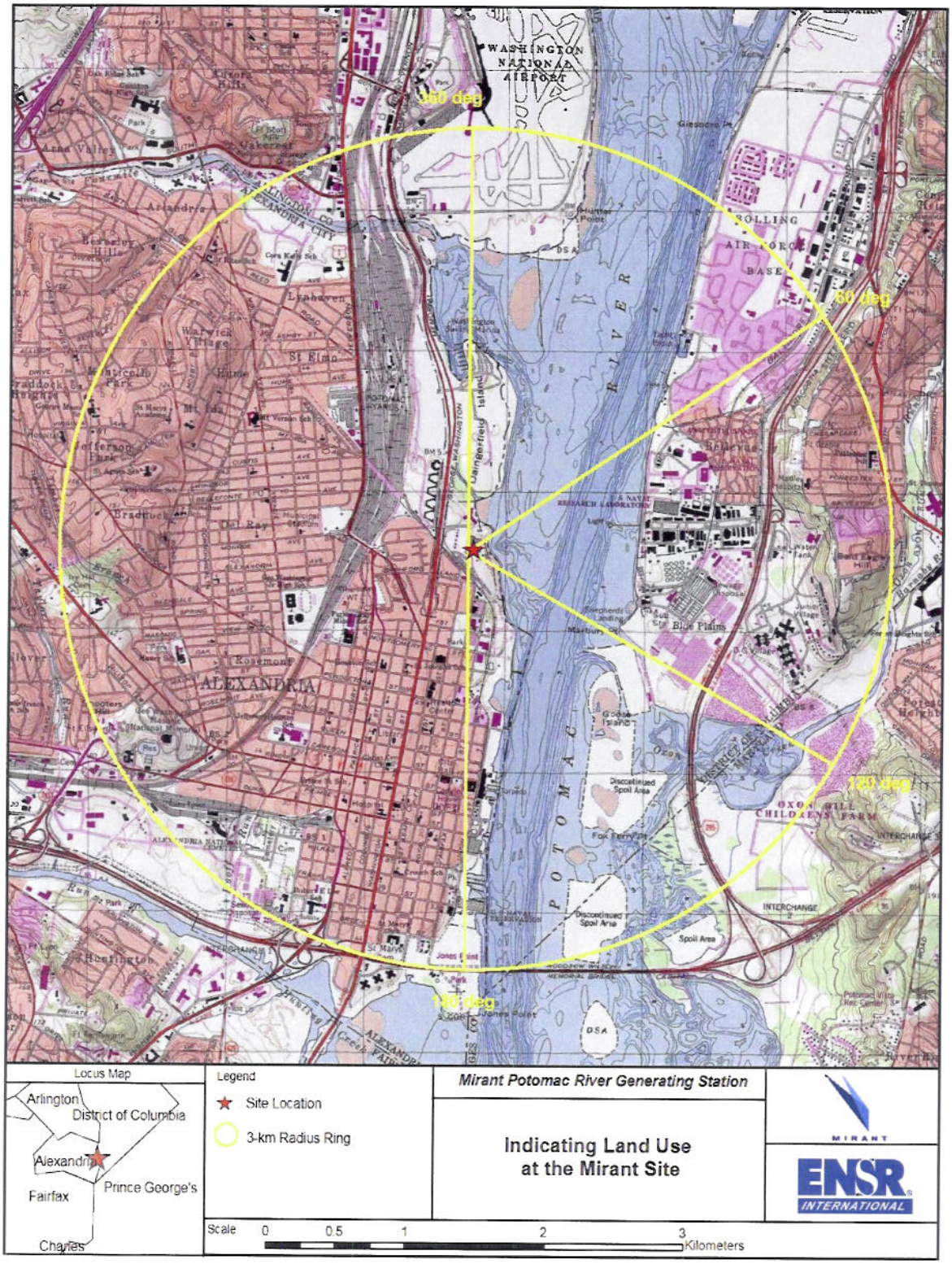
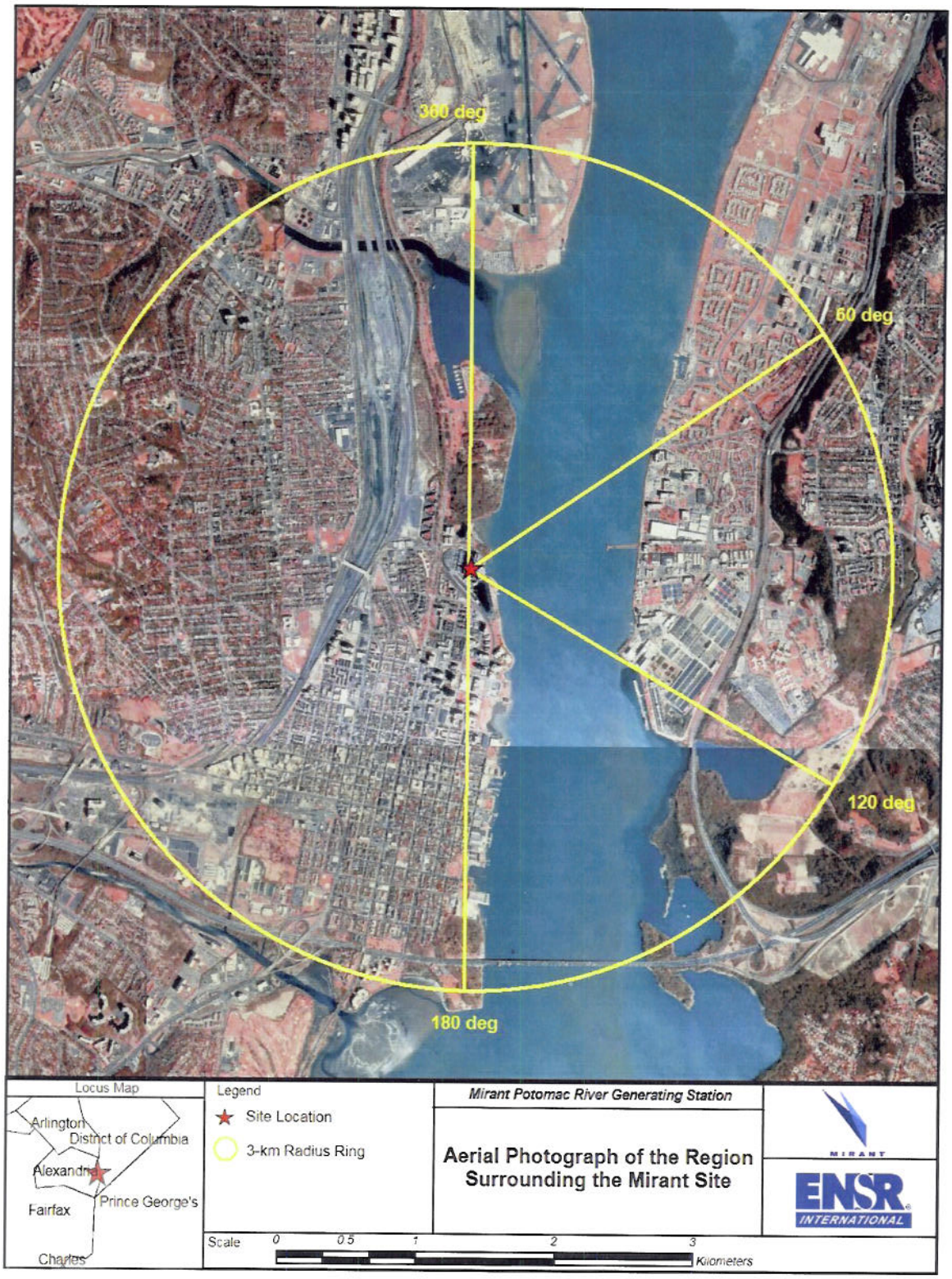


Figure 3-7 Aerial Photo of the Region Surrounding the Mirant Site



The seasonal values for each land classification that are needed based on the above sectors are provided in the AERMET user's guide (USEPA 1998). Using these values, site-specific seasonal values of Albedo, surface roughness and Bowen ratio were calculated and are listed in Appendix D. The Bowen ratio will have different annual values because of its dependency on moisture conditions. Each month was classified as average, dry, or wet, based on monthly average precipitation data from Reagan National Airport compared to a 30 year average for each month. The calculated values then were used for that month in determining the weighted average for the sector.

4.0 BACKGROUND AIR QUALITY

Ambient air quality data are used to represent the contribution to total ambient air pollutant concentrations from non-modeled sources. Table 4-1 shows locations and the measured concentrations over the past three available years (2001-2003) of the closest air pollution monitors to the Mirant power plant. Background concentrations of SO_2 and CO were based on the Alexandria City, VA air quality monitoring station data located 1 km to the SW of the power plant. The Alexandria site is classified as residential land use and is in an urban area.

Background air quality concentrations of NO_2 were based on the Arlington County monitoring data. The monitoring station is located 4.4 km to the NW of the Mirant Potomac facility. The Arlington site is classified as commercial land use and located in an urban area.

Ambient background air quality concentrations of PM_{10} were based on Fairfax County monitoring data from either the Sherwood Hall Lane monitor in Mt. Vernon or the Cub Run site on Lee Road.

Table 4-1 Summary of the Background Air Quality Data

Pollutant	Monitor Site	Averaging Period	Measured Concentrations ($\mu g/m^3$)*			NAAQS ($\mu g/m^3$)
			2001	2002	2003	
SO_2	517 N Saint Asaph St, Alexandria City, VA	3-hour	207.0	238.4*	186.0	1300
		24-hour	57.6	55.0	60.3*	365
		Annual	15.7*	15.7*	15.7*	80
PM_{10}	2675 Sherwood Hall Lane/Cub Run, Lee Rd	24-hour	45*	45*	38	150
		Annual	21*	19	20	50
NO_2	S 18th And Hayes St, Arlington County, VA	Annual	41.4	41.4	48.9*	100
CO	517 N Saint Asaph St, Alexandria City, VA	1-hour	4945.0*	4600.0	4025.0	40,075
		8-Hour	2760.0	2760.0	3220.0*	10,305

* Short-term and annual values are highest in each year.
Short-term concentrations reported as highest of the second highest and annual concentrations reported as mean.

5.0 AERMOD MODELING RESULTS

5.1 Sulfur Dioxide (SO_2) Results

Table 5-1 presents results of modeling SO_2 emissions from the combustion stacks at PRGS. Highest second-highest 3-hour and 24-hour impacts and highest annual average impacts for each year are presented in the table. Modeled impacts are added to the highest monitored concentrations listed in Table 4-1 for comparison with the NAAQS. All highest predicted impacts from PRGS are predicted on the flagpole receptors at the top of Marina Towers. Figure 5-1 shows the locations of maximum predicted impacts for various pollutants.

The maximum 3-hour SO_2 concentration is 9,263 ug/m^3. Most of this concentration is contributed by the power plant. This concentration exceeds the 1,300 ug/m^3 NAAQS.

The maximum 24-hour SO_2 concentration is 5,061 ug/m^3. Most of this concentration is contributed by the power plant. This concentration exceeds the 365 ug/m^3 NAAQS.

The maximum annual average concentration is 693 ug/m^3. This concentration exceeds the 80 ug/m^3 NAAQS.

5.2 PM_{10} Results

Table 5-2 presents results of modeling PM_{10} emissions from the combustion stacks and material handling equipment at PRGS. Highest second-highest 24-hour impacts and highest annual average impacts for each year are presented in the table. Modeled impacts are added to the highest monitored concentrations listed in Table 4-1 for comparison with the NAAQS. Most of the highest predicted impacts from PRGS are predicted on the flagpole receptors at the top of Marina Towers. Two of the highest impacts are predicted at the fenceline along the southern plant boundary

The maximum 24-hour PM_{10} concentration based on the highest, second highest (H2H) value over the five year modeling period, is 442 ug/m^3. The 24-hour NAAQS stipulates that a violation occurs when the standard is exceeded, on average, more than one day each year over a three year period. When conducting a 5-year modeling study, a violation of the NAAQS is predicted when the highest, sixth highest (H6H) concentration over the 5-year period is predicted to exceed the NAAQS. The H6H concentration was predicted to be 418.7 ug/m^3. Nearly all of the H2H and H6H concentrations are contributed by combustion stacks at the power plant. These concentrations exceed the 150 ug/m^3 NAAQS.

The maximum annual average concentration is 76 ug/m^3. Most of this concentration is contributed by combustion stacks at the power plant. This concentration exceeds the 50 ug/m^3 NAAQS.

5.3 Nitogen Oxides (as NO_2) Results

Table 5-3 presents results of modeling NOx emissions from combustion stacks at PRGS. Highest predicted concentrations are listed for each year. Modeled impacts are added to the highest monitored concentration listed in Table 4-1 for comparison with the NAAQS. Nearly all highest impacts are predicted on the flagpole receptors at the top floor of Marina Towers.

The highest annual average NO_2 concentration is 199 ug/m^3. This value exceeds the 100 ug/m^3 NAAQS.

5.4 Carbon Monoxide (CO) Results

Table 5-4 presents results of modeling CO emissions from the combustion stacks at PRGS. Highest second-highest 1-hour and 8-hour impacts for each year are presented in the table. Modeled impacts are added to the highest monitored concentrations listed in Table 4-1 for comparison with the NAAQS. Highest predicted 1-hour impacts from PRGS are predicted on top of Alexandria House located approximately 0.9 km SSW of PRGS. Highest 8-hour impacts are predicted at flagpole receptors on top of Marina Towers.

The maximum 1-hour CO concentration is 12,985 ug/m^3. This concentration is below the 40,000 ug/m^3 NAAQS, thus demonstrating compliance.

The maximum 8-hour CO concentration is 7,340 ug/m^3. This concentration is below the 10,000 ug/m^3 NAAQS, also demonstrating compliance.

5.5 Mercury Results

Table 5-5 presents results of modeling mercury emissions from the combustion stacks at PRGS. Highest second-highest 1-hour and highest annual average impacts for each year are presented in the table. Modeled impacts are compared with the VADEQ Standards of Performance for Toxic Pollutants. Highest predicted 1-hour impacts from PRGS are predicted on top of Alexandria House located approximately 0.9 km SSW of PRGS. Highest annual impacts are predicted at flagpole receptors on top of Marina Towers.

The maximum 1-hour mercury concentration is 0.072 ug/m^3. This concentration is below the 1.25 ug/m^3 Standard of Performance, thus demonstrating compliance.

The maximum annual average mercury concentration is 0.003 ug/m^3. This concentration is below the 0.05 ug/m^3 Standard of Performance, also demonstrating compliance.

5.6 Conservatism of Modeling Results

This analysis was performed to assess compliance with ambient standards. The analysis incorporated several conservative assumptions to ensure that the absolute maximum pollutant concentrations are predicted. Actual maximum pollutant concentrations due to the power plant are likely much lower than the maximum predicted concentrations presented in this report. For example, modeling assumed that all combustion sources at the power plant are operating at maximum load for the entire year even though the power plant typically operates at about a 60% annual capacity factor. In addition, because Mirant is a significant contributor to existing background concentrations, the addition of existing background concentrations to Mirant's predicted ambient impacts in this analysis has the effect of double counting Mirant's contribution.

Marina Towers, a high rise residential complex, was constructed without considering the effects of pre-existing emissions from the power plant and the building of this structure adjacent to the existing power plant increased the downwash effect. Nevertheless, receptors were placed at all levels of this structure to ensure that maximum air pollutant impacts are identified. Ground-level air pollutant concentrations are predicted to be approximately 56%, 73% and 76% of the maximum concentrations on top of Marina Towers for the 3-hour, 24-hour and annual averaging periods, respectively.

Figure 5-1 Locations of Maximum Air Pollutant Concentrations From Potomac River Generating Station

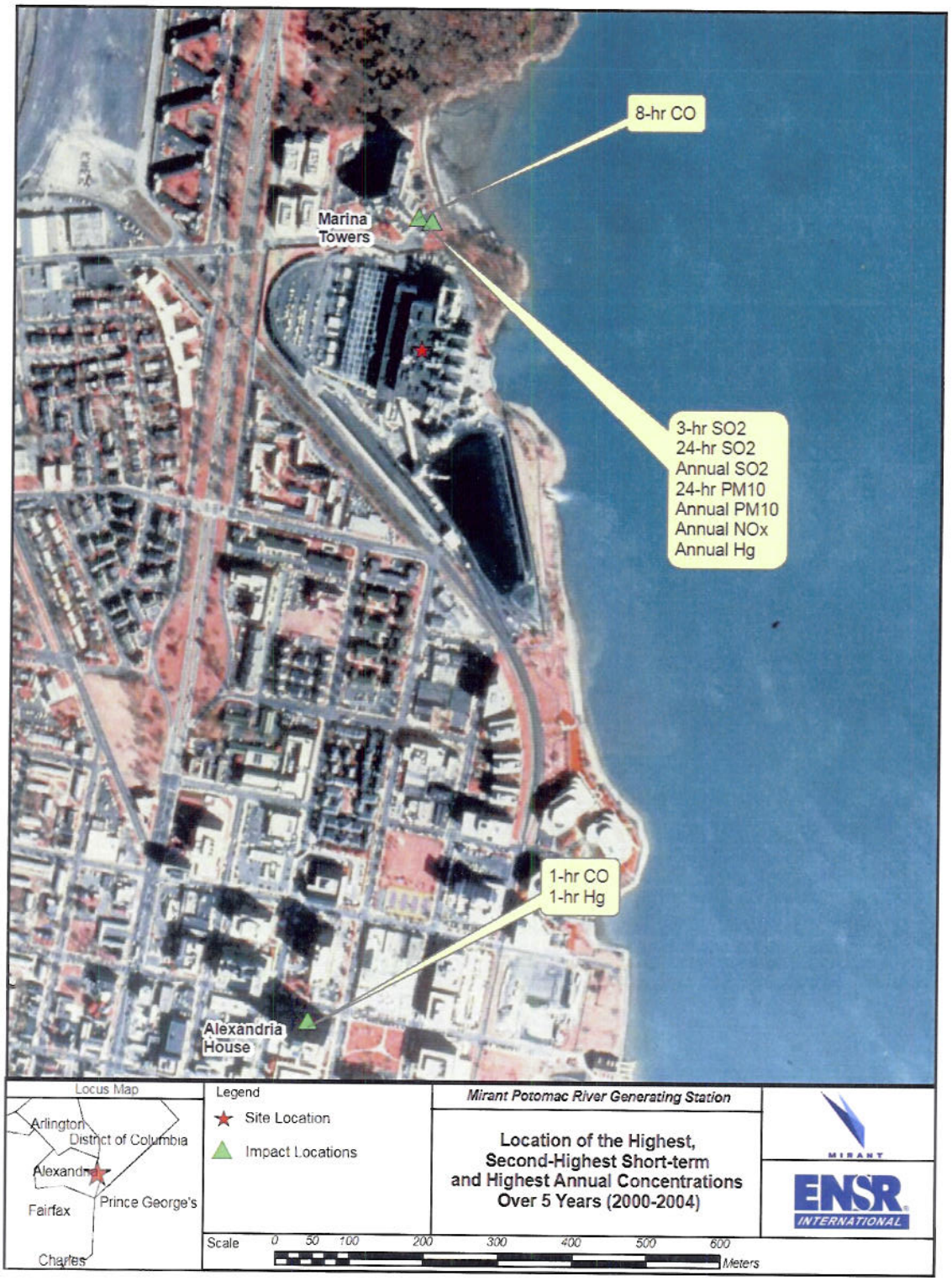


Table 5-1 AERMOD Modeling Results for SO_2

Year	Pollutant	Averaging Period	AERMOD-PRIME	Monitored Background	AERMOD-PRIME + Background (1)	NAAQS	Distance	Direction	Ground Elevation	Flagpole Elevation
			Concentrations ($\mu g/m^3$)				m	deg	m	m
2000	SO_2	3-hour	8,433.5	238.4	8,671.9	1300	174.8	354	4.6	39.6
		24-hour	5,000.5	60.3	5,060.8	365	174.8	354	4.6	39.6
		Annual	605.7	15.7	621.4	80	174.8	354	4.6	39.6
2001	SO_2	3-hour	9,024.5	238.4	9,262.9	1300	174.8	354	4.6	39.6
		24-hour	4,651.2	60.3	4,711.5	365	174.8	354	4.6	39.6
		Annual	677.3	15.7	693.0	80	174.8	354	4.6	39.6
2002	SO_2	3-hour	8,169.5	238.4	8,407.9	1300	174.8	354	4.6	39.6
		24-hour	4,779.6	60.3	4,839.9	365	174.8	354	4.6	39.6
		Annual	575.1	15.7	590.8	80	174.8	354	4.6	39.6
2003	SO_2	3-hour	7,010.2	238.4	7,248.6	1300	174.8	354	4.6	39.6
		24-hour	3,014.9	60.3	3,075.2	365	174.8	354	4.6	39.6
		Annual	305.4	15.7	321.1	80	51.1	87	4.8	0.0
2004	SO_2	3-hour	7,120.1	238.4	7,358.5	1300	174.8	354	4.6	39.6
		24-hour	2,923.0	60.3	2,983.3	365	102.7	133	6.7	0.0
		Annual	401.6	15.7	417.3	80	174.8	354	4.6	39.6

(1) SO_2 background air quality data was based on the highest concentrations over the past three years (2001-2003) from the monitor located at 517 N Saint Asaph St., Alexandria City, VA.

Table 5-2 AERMOD Modeling Results for PM_{10}

Year	Pollutant	Averaging Period	AERMOD-PRIME	Monitored Background	AERMOD-PRIME + Background (1)	NAAQS	Distance	Direction	Ground Elevation	Flagpole Elevation
			Concentrations ($\mu g/m^3$)				m	deg	m	m
2000	PM10	24-hour	397.0	45	442.0	150	174.8	354	4.6	39.6
		Annual	49.1	21	70.1	50	174.8	354	4.6	39.6
2001	PM10	24-hour	369.1	45	414.1	150	174.8	354	4.6	39.6
		Annual	54.9	21	75.9	50	174.8	354	4.6	39.6
2002	PM10	24-hour	380.0	45	425.0	150	174.8	354	4.6	39.6
		Annual	46.5	21	67.5	50	174.8	354	4.6	39.6
2003	PM10	24-hour	239.5	45	284.5	150	174.8	354	4.6	39.6
		Annual	30.9	21	51.9	50	283.1	179	10.6	0.0
2004	PM10	24-hour	220.7	45	265.7	150	174.8	354	4.6	39.6
		Annual	32.8	21	53.8	50	51.0	73	5.0	0.0
The sixth highest PM_{10} 24-hour concentration = 373.7 $\mu g/m^3$. After adding a 45 $\mu g/m^3$ monitored background, the impact = 418.7 $\mu g/m^3$.										

(1) PM_{10} background air quality data was based on the highest concentrations over the past three years (2001-2003) from the monitor located at 2675 Sherwood Hall Lane. Of Cub Run, Lee Rd, both monitors located in Fairfax County.

Table 5-3 AERMOD Modeling Results for NOx

Year	Pollutant	Averaging Period	AERMOD-PRIME (1)	Monitored Background	AERMOD-PRIME + Background (2)	NAAQS	Distance	Direction	Ground Elevation	Flagpole Elevation
			Concentrations ($\mu g/m^3$)				m	deg	m	m
2000	NO_2	Annual	134.4	48.9	183.3	100	174.8	354	4.6	39.6
2001	NO_2	Annual	150.3	48.9	199.2	100	174.8	354	4.6	39.6
2002	NO_2	Annual	127.6	48.9	176.5	100	174.8	354	4.6	39.6
2003	NO_2	Annual	67.8	48.9	116.7	100	51.1	87	4.8	0.0
2004	NO_2	Annual	89.1	48.9	138.0	100	174.8	354	4.6	39.6

(1) NOx concentrations were multiplied by 0.75 to obtain NO_2 estimates in accordance with USEPA guidelines.
(2) NOx background air quality data was based on the highest concentrations over the past three years (2001-2003) from the monitor located at S 18th and Hayes St., Arlington County, VA.

Table 5-4 AERMOD Modeling Results for CO

Year	Pollutant	Averaging Period	AERMOD-PRIME	Monitored Background	AERMOD-PRIME + Background (1)	NAAQS	Distance	Direction	Ground Elevation	Flagpole Elevation
			Concentrations ($\mu g/m^3$)				m	deg	m	m
2000	CO	1-hour	6,253	4,945	11,198	40,000	903.7	191	8.0	66.0
		8-hour	3,841	3,220	7,061	10,000	174.8	354	4.6	39.6
2001	CO	1-hour	7,721	4,945	12,666	40,000	903.7	191	8.0	66.0
		8-hour	4,120	3,220	7,340	10,000	182.7	349	6.1	39.6
2002	CO	1-hour	6,588	4,945	11,533	40,000	903.7	191	8.0	66.0
		8-hour	4,040	3,220	7,260	10,000	182.7	349	6.1	39.6
2003	CO	1-hour	8,000	4,945	12,945	40,000	903.7	191	8.0	66.0
		8-hour	3,055	3,220	6,275	10,000	174.8	354	4.6	39.6
2004	CO	1-hour	8,040	4,945	12,985	40,000	903.7	191	8.0	66.0
		8-hour	3,199	3,220	6,419	10,000	174.8	354	4.6	39.6

(1) CO background air quality data was based on the highest concentrations over the past three years (2001-2003) from the monitor located at 517 N Saint Asaph St., Alexandria City, VA.

Table 5-5 AERMOD Modeling Results for Hg

Year	Pollutant	Averaging Period	AERMOD-PRIME	TLV-TWA	Distance	Direction	Ground Elevation	Flagpole Elevation
			Concentrations ($\mu g/m^3$)		m	deg	m	m
2000	Hg	1-hour	0.056	1.25	903.7	191	8.0	66.0
		Annual	0.0031	0.05	174.8	354	4.6	39.6
2001	Hg	1-hour	0.069	1.25	903.7	191	8.0	66.0
		Annual	0.0034	0.05	174.8	354	4.6	39.6
2002	Hg	1-hour	0.059	1.25	903.7	191	8.0	66.0
		Annual	0.0029	0.05	174.8	354	4.6	39.6
2003	Hg	1-hour	0.071	1.25	903.7	191	8.0	66.0
		Annual	0.0016	0.05	51.1	87	4.8	0.0
2004	Hg	1-hour	0.072	1.25	903.7	191	8.0	66.0
		Annual	0.0020	0.05	174.8	354	4.6	39.6

6.0 CONCLUSIONS

Worst-case modeling results indicate that aerodynamic downwash of stack gas effluent produces exceedances of the NAAQS for SO_2, PM_{10} and NO_2.assuming that the facility operates at maximum possible load for the entire year and emits pollutants at the maximum allowable rates and highest impacts for comparison to the NAAQS are based on results at the top of Marina Towers. Maximum predicted concentrations of CO and mercury are well below corresponding ambient standards.

Actual air pollutant concentrations are expected to be considerably lower than predicted because:

- Actual hourly air pollutant emissions are considerably less than maximum allowable emissions
- The power plant operates at approximately 60% capacity on an annual average basis
- Ambient background concentrations are generally lower than the values added to modeled impacts

Maximum predicted air pollutant impacts are generally predicted on top of Marina Towers. This is because Marina Towers was built without considering the effects of pre-existing emissions from the power plant. In the absence of Marina Towers, maximum air pollutant concentrations are predicted at ground level and are approximately 56%, 73% and 76% of the maximum concentrations on top of Marina Towers for the 3-hour, 24-hour and annual averaging periods, respectively.

Mirant will propose a plan and schedule to eliminate these exceedances on a timely basis. This plan and schedule will be submitted by November 14, 2005 in accordance with the Consent Order.

7.0 REFERENCES

EPA 1985. *Guideline for the Determination of Good Engineering Practice Stack Height (Technical Support Document for the Stack Height Regulations) - Revised.* EPA-450/4-80-023R, U.S. Environmental Protection Agency, Research Triangle Park, NC 27711.

EPA 1990. *New Source Review Workshop Manual.* Draft October 1990. U.S. Environmental Protection Agency, Research Triangle Park, NC 27711.

EPA 1997. *Guideline on Air Quality Models (Revised).* EPA-450/2-78-027R, U. S. Environmental Protection Agency, Research Triangle Park, NC 27711.

EPA 1998. *Revised Draft User's Guide for the AERMOD Meteorological Preprocessor (AERMET).* U. S. Environmental Protection Agency, Research Triangle Park, NC 27711.

EPA, 2004. Control of Mercury Emissions from Coal-Fired Electric Utility Boilers. Air Office of Research and Development, February 27. EPA's Technology Transfer Network Air Toxics Website/Electric Utility Steam Generating Units NESHAPS

Paine, R.J., R.F. Lee, R. Brode, R.B. Wilson, A.J. Cimorelli, S.G. Perry, J.C. Weil, A. Venkatram and W. Peters, 1998. Model Evaluation results for AERMOD. EPA website www.epa.gov/scram001

Standards of Performance for Toxic Pollutants 9VAC5-60-230
http://leg1.state.va.us/cgi-bin/legp504.exe?000+reg+9VAC5-60-230

APPENDIX A

CONSENT ORDER REGARDING A DOWNWASH STUDY

&

AGENCY CORRESPONDANCE

MIRANT POTOMAC RIVER GENERATING STATION

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

W. Taylor Murphy, Jr.
Secretary of Natural Resources

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Director

Jeffery A. Sloers
Regional Director

COMMONWEALTH OF VIRGINIA
STATE AIR POLLUTION CONTROL BOARD

ORDER BY CONSENT

ISSUED TO

MIRANT POTOMAC RIVER, LLC
Registration No. 70228

SECTION A: Purpose

This is a Consent Order issued under the authority of Va. Code § § 10.1-1307D and 10.1-1307.1, between the Board and Mirant Potomac River, LLC for the purpose of ensuring compliance with ambient air quality standards incorporated at 9 VAC Chapter 30 and Va. Code § 10.1-1307.3(3) requiring certain emissions modeling and analysis related to the Potomac River Power Station located in Alexandria, Virginia.

SECTION B: Definitions

Unless the context clearly indicates otherwise, the following words and terms have the meanings assigned to them below:

1. "Va. Code" means the Code of Virginia (1950), as amended.

2. "Board" means the State Air Pollution Control Board, a permanent collegial body of the Commonwealth of Virginia as described in Va. Code §§ 10.1-1301 and 10.1-1184.

3. "Department" or "DEQ" means the Department of Environmental Quality, an agency of the Commonwealth of Virginia as described in Va. Code § 10.1-1183.

4. "Director" means the Director of the Department of Environmental Quality.

5. "Order" means this document, also known as a Consent Order.

6. "Mirant," means Mirant Potomac River, LLC, a limited liability company qualified to do business in Virginia. Mirant Potomac River, LLC is owned Mirant Corporation and operated by Mirant Mid-Atlantic, LLC.

7. "Facility" means the Potomac River Generating Station owned and operated by Mirant located at 1400 North Royal Street, Alexandria, Virginia, 22314. The facility is a five unit, 488 MW coal-fired electric generating plant.

8. "NVRO" means the Northern Virginia Regional Office of DEQ, located in Woodbridge, Virginia.

9. "The Permit" means the Stationary Source Permit to Operate issued by DEQ to the facility on September 18, 2000, pursuant to 9 VAC 5-80-800, *et seq.*

10. "Marina Towers" means a multiple unit residential condominium building located at 501 Slaters Lane, Alexandria, Virginia, in close proximity to the facility.

11. "Downwash" means the effect that occurs when aerodynamic turbulence induced by nearby structures causes pollutants from an elevated source (such a smokestack) to be mixed rapidly toward the ground resulting in higher ground-level concentrations of pollutants.

12. "NAAQS" means the primary national ambient air quality standards established by the U.S. Environmental Protection Agency for certain pollutants, including sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), ozone, and particulate matter (PM), pursuant to § 109 of the federal Clean Air Act, 42 USC § 7409, set forth at 40 CFR Part 50 and incorporated at 9 VAC Chapter 30. NAAQS are established at concentrations necessary to protect public health with an adequate margin of safety.

13. "NOx" means oxides of nitrogen, which is a pollutant resulting from the combustion of fossil fuels and a precursor to the formation of ozone.

14. "PM_{10}" means particulate matter with an aerodynamic diameter less than or equal to 10 micrometers and is a pollutant resulting from, among other things, the combustion of fossil fuels.

SECTION C: Findings of Fact and Conclusions of Law

1. In order to ensure compliance with the Northern Virginia area's National Ambient Air Quality Standard (NAAQS) for ozone, the Department is in the process of revising the facility's Stationary Source Permit to Operate for the purpose of clarifying the facility's ozone season

(May 1 through September 30) emission requirements for NOx. A public hearing on the proposed permit revision was held in Alexandria, Virginia, on the evening of April 12, 2004.

2. Among the comments offered at the public hearing by Alexandria residents was that DEQ should require Mirant to perform comprehensive modeling to assess the impact of emissions from the facility on the area in the immediate vicinity of the facility.

3. At or about the time of the public hearing, certain residents of Alexandria, Virginia, provided the Department with a document entitled "Screening-Level Modeling Analysis of the Potomac River Power Plant Located in Alexandria, Virginia" prepared by Sullivan Environmental Consulting, Inc., dated March 29, 2004 (the Sullivan Screening). The Sullivan Screening was commissioned by, among others, certain residents of Marina Towers for the purpose of assessing whether emissions from the facility may cause exceedances of certain NAAQS at Marina Towers as a result of "downwash." The Sullivan Screening concluded that, "on average, meteorological conditions associated with plume impaction conditions on the Marina Towers condominium were screened to occur as often as 1,200 hours per year."

4. Although the Sullivan Screening does not establish conclusively that emissions from the facility result in exceedances of the NAAQS at Marina Towers, the Department believes that the results of the Sullivan Study warrant that further comprehensive analysis be conducted in accordance with DEQ and EPA approved modeling procedures in order to more fully determine the effect of emissions from the facility on the ambient air quality at Marina Towers and in the area in the immediate vicinity of the facility.

SECTION D: Agreement and Order

Accordingly, the Board, by virtue of the authority granted it in Va. Code §§ 10.1-1307 D and 10.1-1307.1 orders Mirant, and Mirant agrees, to perform the actions described in this section of the Order:

1. Mirant shall perform a refined modeling analysis to assess the effect of "downwash" from the facility on ambient concentrations of SO_2, NO_2, CO, and PM_{10} for comparison to the applicable NAAQS in the area immediately surrounding the facility. In addition, Mirant shall perform a refined modeling analysis to assess the effect of "downwash" from the facility on ambient concentrations of mercury for comparison to the applicable Standards of Performance for Toxic Pollutants set forth in 9 VAC 5-60-200, *et seq.*, in the area immediately surrounding the facility.

2. The protocol and methodology for the modeling analysis shall be in accordance with EPA and DEQ methods and shall be approved by DEQ prior to commencement of the modeling. Mirant shall submit a proposed modeling protocol and methodology to Kenneth L. McBee, DEQ Air Modeling Program Coordinator, 629 E. Main St., Richmond VA 23219, within twenty-one (21) days of the effective date of this Order.

3. Mirant shall perform the modeling analysis immediately upon receiving written approval of the modeling protocol and methodology from DEQ. Mirant shall submit the results of the modeling analysis to Mr. McBee and the Director of the Department's Northern Virginia Regional Office no later than sixty (60) days after Mirant receives written approval of the modeling protocol and methodology.

4. In the event the modeling analysis indicates that emissions from the facility may cause exceedances of the NAAQS for SO_2, NO_2, CO, or PM_{10}, or exceedances of the Standards of Performance for Toxic Pollutants for mercury in the area immediately surrounding the facility, DEQ shall require Mirant to submit to DEQ, within ninety (90) days of submitting the modeling analysis, a plan and schedule to eliminate and prevent such exceedances on a timely basis. Upon review and approval of that plan and schedule by DEQ, the approved plan and schedule shall be incorporated by reference into this Order.

5. Mirant agrees to waive any objections it may otherwise be entitled to assert under law should DEQ seek to incorporate the approved plan and schedule into the facility's permit.

Section E: Administrative Provisions

1. The Board may modify, rewrite, or amend this Order with the consent of Mirant for good cause shown by Mirant, or after a proceeding as required by the Administrative Process Act for a case decision.

2. This Order addresses only those issues specifically identified herein. This Order shall not preclude the Board or the Director from taking any action authorized by law, including, but not limited to seeking subsequent remediation of the facility as may be authorized by law and/or taking subsequent action to enforce the terms of this Order. This order shall not preclude appropriate enforcement actions by other federal, state or local regulatory agencies for matters not addressed herein.

3. Solely for the purposes of the execution of this Order, for compliance with this Order, and for subsequent actions with respect to this Order, Mirant consents to the jurisdictional allegations and conclusions of law contained herein.

4. Mirant declares it has received fair and due process under the Administrative Process Act, Va. Code §§ 2.2-4000 *et seq.*, and the Air Pollution Control Law and it waives the right to any hearing or other administrative proceeding authorized or required by law or regulation, and to any judicial review of any issue of fact or law contained herein. Nothing herein shall be construed as a waiver of the right to any administrative proceeding for, or to judicial review of, any action taken by the Board to modify, rewrite, amend, or enforce this Order, or any subsequent deliverables required to be submitted by Mirant and approved by the Department, without the consent of Mirant.

5. Failure by Mirant to comply with any of the terms of this Order shall constitute a violation of an order of the Board. Nothing herein shall waive the initiation of appropriate enforcement actions or the issuance of additional orders as appropriate by the Board or Director as a result of such violations.

6. If any provision of this Order is found to be unenforceable for any reason, the remainder of the Order shall remain in full force and effect.

7. Mirant shall be responsible for failure to comply with any of the terms and conditions of this Order unless compliance is made impossible by earthquake, flood, other acts of God, war, strike, or other such circumstance. Mirant must show that such circumstances resulting in noncompliance were beyond its control and not due to a lack of good faith or diligence on its part. Mirant shall notify the Director, NVRO, in writing when circumstances are anticipated to occur, are occurring, or have occurred that may delay compliance or cause noncompliance with any requirement of this Order. Such notice shall set forth:

a. The reasons for the delay or noncompliance;

b. The projected duration of any such delay or noncompliance;

c. The measures taken and to be taken to prevent or minimize such delay or noncompliance; and

The timetable by which such measures will be implemented and the date full compliance will be achieved.

Failure to so notify the Director, NVRO, in writing within 24 hours of learning of any condition above, which Mirant intends to assert will result in the impossibility of compliance, shall constitute a waiver of any claim of inability to comply with a requirement of this Order.

8. This Order is binding on the parties hereto, parent corporations, or their successors in interest, designees, assigns.

9. This Order shall become effective upon execution by both the Director of the Department of Environmental Quality or his designee and Mirant.

10. This Order shall continue in effect until:

a. Mirant petitions the Director or his designee to terminate the order after it has completed all of the requirements of the Order and the Director or his designee approves the termination of the Order; or

b. The Director or Board terminates the Order in his or its sole discretion upon 30 days written notice to Mirant.

Termination of this Order, or of any obligation imposed in this Order, shall not operate to relieve Mirant from its obligation to comply with any statute, regulation, permit condition, other order, certificate, certification, standard, or requirement otherwise applicable.

AND IT IS ORDERED this 23rd day of September 2004.

By: _____
Robert G. Burnley, Director
Department of Environmental Quality

Mirant Potomac River, LLC, voluntarily agrees to the issuance of this Order.

MIRANT POTOMAC RIVER, LLC

by: _____
Lisa D. Johnson, President

The foregoing instrument was signed and acknowledged before me on this 17th day of Sept. 2004 by Lisa D. Johnson of Mirant Potomac River, LLC, in the City of County of Prince George, Commonwealth of Virginia.

_____
Notary Public

My Commission expires: 06/07/05

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

W. Tayloe Murphy, Jr.
Secretary of Natural Resources

Street address: 629 East Main Street, Richmond, Virginia 23219
Mailing address: P.O. Box 10009, Richmond, Virginia 23240
Fax (804) 698-4500 TDD (804) 698-4021
www.deq.state.va.us

Robert G. Burnley
Director

(804) 698-4000
1-800-592-5482

February 10, 2005

Dave Shea
Sr. Program Manager
ENSR Corporation
2 Technology Park Drive
Westford, MA 01886

Dear Mr. Shea:

I am writing this letter in response to your Protocol for Modeling the Effects of Downwash from the Mirant's Potomac River Power Plant dated October 2004. As part of Department of Environmental Quality (DEQ)'s review of this document, I have reviewed and considered comments on this protocol from a local neighborhood association and the city of Alexandria.

First of all, I would like to state that the specific Potomac River Power Plant emissions data used in the proposed Downwash Study will be agreed to by the Northern Virginia Regional Office staff. PM2.5 emissions will not be considered due to the lack of an EPA-approved analysis model or procedure. However, PM10 (analyzed as a surrogate for PM2.5), as well as the other specified criteria pollutants will be considered for the total plant operation to include coal and ash yards in the study. You should work closely with the regional staff to develop the worst case emissions and stack parameters for this facility.

As to the proposed model, AERMOD, DEQ has requested approval to use this model since it is still not promulgated and has received it from the USEPA, Region III, Regional Director. Although there are technical disagreements among professional modelers about the location to be examined for land use characteristics, the center of this study should be the placed at the power plant.

Upon reviewing topographic maps and aerial photographs of the area, the Marina Towers as well as some other high rise buildings that are close by should be addressed in the analysis to determine downwash characteristics to be included in the AERMOD model runs. I realize that this will take some time to gather additional dimensions of these buildings.

Also, several discrete receptors have been suggested by the local citizens. In order to determine the worst case concentrations in the area, prepare a refined modeling area receptor grid out to 5 km with receptors placed every 100 m. This grid of receptors should be representative of the air quality for all the specific discrete receptors requested by the populace in the area. If the concentration gradient is decreasing at the 5 km distance and the concentrations are less than the air quality standards promulgated by EPA and this agency, then the modeling area is limited at that point. This receptor grid should also include flag pole receptors for all nearby raised structures. The flagpole receptors should be placed at access points on each level or floor of the nearby raised structures.

After responding to this letter with your amended protocol by March 15, I will supply you with the appropriate monitored background values for the modeled criteria pollutants.

Sincerely yours,

Kenneth L. McBee
Air Quality Modeler

Cc: Larry Labrie, Mirant Corp
John McKie, Air Permitting Engineer, NVRO
Terry Darton, Air Permitting Manager, NVRO

Comments on the Protocol, Revised March 24, 2005,
For Mirant's Potomac River Generating Station Air Impacts Modeling
By John McKie, April 25, 2005 (Revised May 5, 2005)

Note: I have also provided comments on the City of Alexandria's letter regarding this same protocol. I may want to make additional comments on the protocol or revise some of what I have written below, depending on the response, if any, from the City of Alexandria regarding my comments to the City.

My comments are limited to information provided in the protocol regarding the Potomac River Generating Station and non-meteorological inputs to the modeling. I defer to Ken McBee for comment on the modeling methods, the meteorological inputs to the models, and how the results should be analyzed and presented.

1. I am satisfied with the methodology for determining the emission rates presented in Table 2-1 for SO_2, NO_X, and TSP/PM_{10}. However, the pounds per hour or grams per second are all based on the design heat input rate given in the second column of Table 2-1. Discussions between DEQ and Mirant and review by the City of Alexandria of Department of Energy data suggest that actual heat input rates are often greater than the design rates. The heat rates used to determine the emission rates to be modeled should be the highest (three hour average) that might actually occur other than as a result of malfunction.

2. The CO rates in Table 2-1 are noted as being 10% greater than the maxima from the last calendar year of CEM data. Without the CEM data I could not verify the numbers, but the approach is reasonable. The numbers are also considerably greater than are derived from AP-42 and the City of Alexandria did not take exception to them. Therefore, I believe we should accept them.

3. To obtain the mercury (Hg) rate found in Table 2-1, ENSR says they divided the annual rate derived from the TRI by 8,760 hours per year. I couldn't find the TRI data ENSR used. On the EPA website I found that the Hg emissions released to the air from the Potomac River Generating Station (PRGS) are given as 71 tons for 2002 in the 2004 update for that year. By dividing 71 tons per year by 8,760 hours, I get 1.62×10^{-3} pounds per hour, which is considerably less than the 2.45×10^{-3} lb/hr that ENSR is proposing. However, for determining short-term impacts to compare with the SAAC (9 VAC 5-60-230), the <u>maximum</u> one-hour emission rate should be used, <u>not</u> the <u>average</u> one-hour rate for the whole year (annual rate/8760), so ENSR's scheme for developing hourly emission rates for mercury is flawed. The City of Alexandria recommended using published test data if Mirant doesn't have adequate test data to account for variability. Published test data in lieu of Mirant's own test data should only be used if the coal in the published test was from the same area(s) as that used (or which may be used) at the PRGS. The protocol should have as the hourly rate for Hg the maximum likely one-hour emission rate.

The protocol should be explicit about how that rate was derived, including general information regarding any testing that was involved (how representative the coal was, the number of tests and approximate dates, which boilers tested, etc.)

4. The stack parameters in Table 2-1 for the boilers match the emissions update for 2003, which is no guarantee they are correct. Given that the temperatures and velocities vary from one stack to the next, I recommend that we require ENSR or Mirant to state how they know the stack information is correct. I assume that temperature and velocities are from stack test data, but it could be outdated data.

5. The dimensions for the silos appear reasonable when I compare the silos to other structures in a photograph. The temperature and velocity are conservative for modeling purposes. We should accept the silo data.

6. The protocol should state how the size and height of the "Area Sources" in Table 2-2 were determined. Are the dimensions taken from engineering design plans, photos, actual measurements, or other?

7. Calculations used to derive the inputs given in this protocol are not well-documented. Appendix B where the calculations are provided, but it mostly just gives the base equations and inputs used, without showing the steps necessary to duplicate most of the calculations that were done. I believe I figured most of them out, but example calculations would be appreciated in the future.

8. In the fly ash silos emission calculations (in Appendix B) the outlet baghouse emissions are assumed as 0.1 grains/acf. The protocol should specify the basis for this and other assumptions in Appendix B.

9. In the bottom ash silo emission calculations (in Appendix B) the outlet baghouse emissions are based on a visual comparison to the fly ash silos baghouse. The protocol should state how a reasonable estimate of emissions was made by this method, given that opacity is highly particle size dependent, and I expect, but don't know for sure, that the bottom ash particles are somewhat larger than the fly ash particles.

10. The size of the coal pile in the coal "Fence – Fugitive Dust Emission Calculations" (in Appendix B) is very confusing. Is it 6 acres as shown some places, or 4 acres as indicated in the boxed results? It should be based on the maximum pile size. How was the size determined? It appears that the results in the box were based on 6 acres, but that is not the size given. Is that correct? (Note: The City of Alexandria says that orthophotography shows a pile area of approximately 7 acres.)

11. Unfortunately, I could not find a copy on the web or elsewhere of the referenced EPA document (EPA -450/3-98-008) from which was taken the emissions equation that was the basis for the coal "Fence – Fugitive Dust Emission Calculations." However, it appears that the term shown as (365-p/235) is supposed to be (365-

p)/235. If that is the case, the protocol should be revised to show it. If not, the calculations are incorrect.

12. If Mirant is using a dust suppressant on the coal pile, the protocol should state how that might affect the validity of the emissions estimating equation.

13. The wind speed used for the peak estimate railcar dumper calculations (in Appendix B) should not be the same as the annual average wind speed. This results in the peak estimate emissions being exactly the same as the annual average. That is clearly incorrect. In fact, emissions (both in this equation and in reality) increase exponentially with wind speed, rather than linearly, so basing even the annual emissions on an annual average wind speed is likely to result in an underestimation, unless the equation was designed specifically for long-term emissions estimates. Furthermore, the protocol does not state why the wind speed was assumed to be 5 miles per hour, but it should.

14. The railcar dumper calculations (in Appendix B) read as if there is a 50% reduction for a partial enclosure and an additional 75% reduction as determined by "Bob Coburn/Benetech." It is not clear if this is double-counting for the partial enclosure or not. The protocol should state what control the 75% reduction accounts for.

15. I believe the calculations in the railcar dumper calculations (in Appendix B) may be incorrect. I find that the UEF for PM_{10} is 4.32×10^{-4}, not 1.80×10^{-4} as the protocol shows. Reducing my result by 50 or 75% to account for any assumed emissions control still does not match any number in the protocol. ENSR should check their calculations and if they still believe theirs are correct, we need to jointly determine why mine are not.

16. On the unlabeled page of Appendix B that has a table and calculations for trucks, there is no indication as to where the equation came from, but I believe it is equation 1 from section 13.2.1.3 of AP-42. This should be confirmed in the protocol.

17. On the truck page, the average truck weight is shown as 16 tons, but it should be the (empty truck wt + the ash per truck) plus the empty returning truck weight all divided by two. That equals [(10 + 22) + 10]/2 = 21 tons.

18. On the truck page, the silt loading of 1 g/m^2 sounds very low to me. The range given in AP-42 for silt loading is 0.03 to 400 g/m^2, but it is hard to imagine any square meter of outdoor pavement with only one gram of dust on a it, much less one with heavy truck traffic near an ash silo and coal pile. The arithmetic mean of the AP-42 range is 200 g/m^2, which represents a very dirty pavement, but that would at least be a conservative number. The protocol should state why a loading of only 1 g/m^2 in this case is a valid assumption.

19. On the truck page, the annual days of rain is given as 150, which leads to an underestimate of emissions. The actual average number of days of more than 0.01

inches of rain at nearby Reagan National Airport is 112. In a drier than average year, it could easily be less than 100 days. However, the emissions total does not vary significantly with a few days difference, so using 100 would be fine.

20. The protocol should either include estimates of fugitive dust emissions from the following processes: working (grading) the coal pile; hopper dump onto the belt to the breaker; the coal breaker; and, the coal bunker, or explain why those emissions do not need to be included.

21. Why is it that the ash silos are indicated in Table 3-2 as not being affected by downwash? They are near the bigger boiler building. (Perhaps Ken McBee can answer this.)

Shea, Dave

From: McKie,John [jrmckie@deq.virginia.gov]
Sent: Monday, May 16, 2005 5:46 PM
To: McBee,Kenneth
Cc: Shea, Dave; larry.labrie@mirant.com; Darton,Terry; David Cramer
Subject: Discussion of My Comments on Protocol of 3/24/05 for Mirant Modeling

Ken,

This afternoon Dave Shea of ENSR, Dave Cramer and Larry Labrie of Mirant, and I participated in a conference call to discuss most of the comments I sent to you (which you subsequently e-mailed to Dave Shea) regarding the protocol, dated March 24, 2005, for the Mirant modeling of emissions to the air from the Potomac River Generating Station (PRGS). I have attached those comments for your convenience. We discussed all of the comments, except those that you and Terry agreed that you would handle; i.e., comments 13, 19, and 21. The following is a list, by comment number, of the actions that were agreed to. I request that the other participants in the conference call please let me, Ken McBee, and the others know if you believe I have misstated any of the proceedings.

1. Similar to the way that maximum CO rates were determined, Dave Cramer will search a few years of measured heat rates at the PRGS units to determine maximum likely heat rates. The heat rates are occasionally, but not normally, greater than the original design heat rates.

2. DEQ accepts the CO rates.

The hourly mercury emission rates were based on the maximum heat rates, but on an average emission factor. Mirant/ENSR will, at my suggestion, look at some way to account for the likelihood that the maximum actual hourly emission rates are greater than the rates based on an average emission factor. In addition, although we did not agree to this, I am also requesting by this e-mail that Mirant/ENSR show the calculations and provide a copy of the relevant TRI page, or state a specific way (e.g., give a webpage URL) for DEQ/public to view the data in the TRI, upon which the calculations are based.

4. The stack parameter variables in Table 2-1 are based on CEM data. The protocol should state that.

5. DEQ accepts the silo data.

6. The heights in Table 2-2 are based on conservatively low engineering judgment estimates. The coal pile height assumes half the average height. The protocol needs to state this.

7. The comment that Appendix B needs more illustrative calculations is a general comment. Mirant/ENSR were advised of some specific instances where more calculations should be shown as we went along.

8. ENSR will provide some examples of real data to support their contention that the assumption of 0.1 grains/acf at the baghouse outlet for the flyash silos is conservative.

9. CH2M-Hill made the emissions estimates. Mirant/ENSR will ask them for specifics on how they did it and put those in the protocol.

10. ENSR based their calculations on the coal pile covering 4 acres. CH2M-Hill had used 6 acres. Dave Cramer says that 4 acres is the maximum, but that additional area may be covered in coal dust, giving the effect of a larger pile when viewed from the air. The protocol should be clarified to prevent confusion about the "6 acres."

11. The equation is actually as I assumed. This will be corrected in the protocol.

12. The protocol will reflect that a dust suppressant is used on the coal pile, and that, if anything, it means that the equation overestimates fugitive emissions.

13. To be resolved by Mirant/ENSR with Ken McBee.

14. The railcar dumper calculations are for both the existing setup and how it will be modified in the future. The calculations should be laid out to make this clear.

15. ENSR will send me their detailed calculations for the railcar dumper emissions, so that I may determine why my results do not match theirs.

16. The protocol will be revised to show that the equation used for trucks is Equation 1 from AP-42, Section 13.2.1.3 of AP-42.

17. The average truck weight will be corrected to 21 tons.

18. ENSR believes, despite my doubts, that the assumption of 1 g/m^3 of silt on the pavement is valid. The protocol must have a citation to support the assumption.

19. To be resolved by Mirant/ENSR with Ken McBee.

20. The protocol will be revised to show that the equation(s) used for calculating the coal pile emissions already account for the other processes mentioned in my comment.

21. To be resolved by Mirant/ENSR with Ken McBee.

John R. McKie, P.E.

Air Permits Group

Northern Virginia Regional Office

Virginia Dept. of Environmental Quality

13901 Crown Court

Woodbridge, VA 22192

Phone: (703) 583-3831

E-mail: jrmckie@deq.virginia.gov

<<Comments on Mirant Modeling Protocol of 3-24-05.doc>>

Shea, Dave

From: McKie,John [jrmckie@deq.virginia.gov]
Sent: Wednesday, May 25, 2005 10:43 AM
To: Shea, Dave
Cc: McBee,Kenneth; Darton,Terry
Subject: RE: Revised Appendix B for Potomac River Gen Sta

Dave,

I looked over the Excel file you sent me with the e-mail below. The revisions satisfy agreed action items numbers 7, 10, 11, 14, 15, and 17 in my e-mail of May 16, which summarizes our May 16 conference call.

Regarding action item #18, the explanation you provided in your e-mail below is sufficient, but must be included in the protocol (either upfront or in Appendix B).

On your spreadsheet labeled "Ash Loader," you added an example calculation, which I encouraged. However, I could not get the math to work in it, until I realized, as is stated farther down the spreadsheet, that the 20% moisture content in the example is supposed to be 10% moisture content. Please make that correction.

Regarding action item #15, in part due to your example calculation, I found where I made a mistake in my attempt to replicate your emission calculations for the railcar dumper. I now believe your results are correct.

When I first reviewed the protocol (March 24 version) I thought that the pages in Appendix B labeled "Ash Loader Upgrade" and "Ash Loading System Dust Suppression" were really the same page with different titles. I neglected to ask you about that. Upon looking at them again as part of the attachment to the e-mail below, I realized that the latter page mentions 65% emission control removal efficiency. However, I do not see where that enters into the calculations. The bottom-line emissions appear to be the same on both pages. What am I missing?

You are welcome to give me a call about any of this or the uncompleted action items, but be aware, that I will be out of the office beginning tomorrow (May 26), returning June 6.

John R. McKie, P.E.
Air Permits Group
Northern Virginia Regional Office
Virginia Dept. of Environmental Quality
13901 Crown Court
Woodbridge, VA 22192
Phone: (703) 583-3831
E-mail: jrmckie@deq.virginia.gov

-----Original Message-----
From: Shea, Dave [mailto:DShea@ensr.com]
Sent: Tuesday, May 24, 2005 1:57 PM
To: McKie,John
Cc: Labrie, Larry A.; Cramer, David S.
Subject: Revised Appendix B for Potomac River Gen Sta

attached is the subject file. Revisions were made based on our conference call on May 16. Please review.

Please note that, besides the changes made to reflect the conference call, we have increased the silt content on paved roads to 6 g/m2. This value is ten times the ubiquitous baseline value for a public road in Table 13.2.1-3 in

AP-42, Section 13.2.1 Paved Roads. We believe the actual silt content to be less than this. The 6 g/m2 value is comparable to the silt loading for iron and steel production (9.7 g/m2), municipal solid waste landfill (7.4 g/m2) and a quarry (8.2 g/m2). Our facility is cleaner than these facilities.

Dave Shea
Sr. Program Manager
ENSR Corporation
2 Technology Park Drive
Westford, MA 01886
978-589-3113

Shea, Dave

From: Cramer, David S. [david.cramer@mirant.com]
Sent: Tuesday, June 14, 2005 12:04 PM
To: McKie,John; McBee,Kenneth
Cc: Shea, Dave; Labrie, Larry A.; Darton,Terry
Subject: RE: Discussion of My Comments on Protocol of 3/24/05 for Mirant Modeling

John and Ken -

I have answers to the few remaining downwash protocol questions that you had, which if I am not mistaken, are items #1 (maximum heat input), #3 (mercury emission rate), and #9 (ash silo emission factors).

Answer to item #1 (maximum heat input):
I reviewed historical data and found the following values are appropriate for use as actual maximum heat input rates, in MBtu/Hr. It should be noted that these values were taken from the CEM system, which calculates boiler heat input reliably, but with a known bias in the stack flow measurement requirements inherent in EPA Method 2. This error typically biases CEM measured flow + 5-10% and also appears in heat input calculations, which use stack flow as an input to the equation.

Unit	Max HI (MBtu/hr)	% Over Rated HI
#1	1,053	8.6%
#2	1,029	6.1%
#3	1,018	6.0%
#4	1,087	13.2%
#5	1,107	15.2%

Answer to item #3 (mercury emission rate):
Mercury emission rate provided in the protocol is based on reported 2003 TRI mercury emissions, which are available on the EPA website. Mirant used EPRI's Lark-Tripp software to produce the TRI report in 2003. In the report, there is a statement of basis for mercury emission estimates, quoted here:

> "In 1998, EPA issued an Information Collection Request (ICR) under authority of Section 114 of the Clean Air Act, for mercury coal data and mercury speciation in flue gas streams. As part of the ICR, 84 power plants were required to conduct mercury speciation stack sampling. EPRI used the results from the ICR stack tests to develop predictive relationships for mercury removal across particulate and SO2 control devices, as well as the form of mercury emitted. These correlations are described in more detail in *An Assessment of Mercury Emissions from U.S. Coal-Fired Power Plants*, EPRI, Report 1000608.
>
> To assist power plants in responding to TRI reporting requirements, the mercury calculational methodology is summarized in *Estimation Methodology for Total and Elemental Mercury Emissions from Coal-Fired Power Plants* (EPRI Report 1001327). These correlations are suggested for use in estimating total and elemental mercury emissions, and are expected to provide a more technically sound estimate than the average removals summarized in the 1995 version of the *Emission Factors Handbook* (1995)."

To illustrate how the average value was arrived upon, I have included the following calculation below:

2003 Po River Coal Burned (lbs):	2,046,312,000	(a)

Coal HHV (Btu/lb):	13,096	(b)
Total Heat Input from Coal (Btu):	26,798,501,952,000	(c) = (a*b)
T Hg Emitted to Air (lbs):	71	(d)
Hg Emission Rate (lb/TBtu):	2.65	(e) = (d/c)

Admittedly, the value I came up with is slightly different from the 2.53 lb/TBtu value given previously, but we are in the same ballpark here, and I am willing to use the higher number.

Answer to item #9 (ash silo emission factors):

Larry Labrie spoke with Ray Porter of CH2MHill, concerning the particulate matter (PM) emission factors used for the bottom ash and fly ash silos in the PM emission inventory developed by CH2MHILL. The emission factors used to compute PM emission rates for the the bottom ash and fly ash silos are 0.1 grains/acf and 0.015 grains/acf, respectively. These PM emission factors are based on CH2MHILL's engineering judgment as representative of emissions from baghouse controls (99% removal efficiency) on ash silos.

During my historical data search, I found stack temperatures and velocities to be in range with those previously provided, therefore I am not offering any revisions to values used in the protocol.

Dave Cramer
Manager - Air Compliance & Permitting
Mirant Corp. - East Region

-----Original Message-----
From: McKie,John [mailto:jrmckie@deq.virginia.gov]
Sent: Monday, May 16, 2005 5:46 PM
To: McBee,Kenneth
Cc: Shea, Dave; Labrie, Larry A.; Darton,Terry; Cramer, David S.
Subject: Discussion of My Comments on Protocol of 3/24/05 for Mirant Modeling

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1. Similar to the way that maximum CO rates were determined, Dave Cramer will search a few years of measured heat rates at the PRGS units to determine maximum likely heat rates. The heat rates are occasionally, but not normally, greater than the original design heat rates.

2. DEQ accepts the CO rates.

3. The hourly mercury emission rates were based on the maximum heat rates, but on an

average emission factor. Mirant/ENSR will, at my suggestion, look at some way to account for the likelihood that the maximum actual hourly emission rates are greater than the rates based on an average emission factor. In addition, although we did not agree to this, I am also requesting by this e-mail that Mirant/ENSR show the calculations and provide a copy of the relevant TRI page, or state a specific way (e.g., give a webpage URL) for DEQ/public to view the data in the TRI, upon which the calculations are based.

4. The stack parameter variables in Table 2-1 are based on CEM data. The protocol should state that.

5. DEQ accepts the silo data.

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20. The protocol will be revised to show that the equation(s) used for calculating the coal pile emissions already account for the other processes mentioned in my comment.

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John R. McKie, P.E.

Air Permits Group

Northern Virginia Regional Office

Virginia Dept. of Environmental Quality

13901 Crown Court

Woodbridge, VA 22192

Phone: (703) 583-3831

E-mail: jrmckie@deq.virginia.gov

<<Comments on Mirant Modeling Protocol of 3-24-05.doc>>

Shea, Dave

From: McKie,John [jrmckie@deq.virginia.gov]
Sent: Thursday, June 16, 2005 11:11 AM
To: Cramer, David S.
Cc: McBee,Kenneth; Shea, Dave; larry.labrie@mirant.com
Subject: RE: Discussion of My Comments on Protocol of 3/24/05 for Mirant Modeling

Dave,

Assuming that the historical data you reviewed covered at least a year and that you used a reasonable methodology for determining "appropriate" maximum heat rates, I am satisfied with your answer to item #1. Include your methodology in the final report.

Your explanation and calculations for item #3 are helpful and should be included in the final report. Still, it is not clear to me whether the modeled mercury emissions represent an industry average or are very specific to your plant. As discussed on May 16, there is considerable variation in mercury contents of coal and we want to try to cover the worst case that applies to your facility. Your rate of 2.65 lb/10^{12} Btu is well below the mean of 8.59 lb/10^{12} Btu found in Table A-2 of EPA's "Control of Mercury Emissions from Coal-fired Electrid Utility Boilers," EPA-600/R/-01-109, April 2002. I tried to find a copy of "Estimation Methodology for Total and Elemental Mercury Emissions from Coal-fired Power Plants," but it appears that it is only available to EPRI members. Mirant's Steve Arabia was quoted in the Washington Post on June I2th as saying, "The coal that we use there (PRGS) has the lowest mercury content of any coal in the mid-Atlantic region." The basis for making that statement r also serve as a basis for claiming that an average mercury emission factor could be considered c ervative for the PRGS, but that basis must be clearly stated.

Although I would prefer a more justifiable approach, as a last resort, you could simply take what you believe is your typical mercury emission rate and double it for your short-term maximum emission rate. The mean plus one standard deviation in the aforementioned Table A-2 is a little less than twice the mean. It is not unusual to assume that the mean plus one standard deviation represents the high end of common occurrences within a normally distributed population of occurrences. I don't believe a normal distribution really applies to Table A-2 and maybe not to the PRGS, but this approach has some, albeit weak, statistical basis. It would be much better if you could assign a rate based on statistical parameters for data that are actually specific to PRGS.

Since our May 16th discussion, I found the "71 pounds" in the 2003 EPA TRI on line, but I still want to see a copy of the table (complete with date/URL) from the TRI appear in the final report, so that it can easily be found and checked by others in the future.

Regarding item #9, I have no way of confirming that CH2M-Hill used "reasonable judgment" as its "good engineering judgment" in setting emission factors for the flyash and bottom ash silos. Please determine the basis for this judgment and pass it along to me, so I will have a defensible basis for accepting or rejecting the proposed emission rates. My own experience suggests that correctly functioning baghouses will achieve at least 99% removal efficiency of the inlet concentration, but I don't know why that means in every, or even most, silos that the outlet emissions are approximately or greater than 0.1 grains/acf for bottom ash and 0.015 grains/acf for flyash. If you are not in a g position to press CH2M-Hill for more information at this time, you can give me Mr. Porter's (CH2M-Hill) number and I will ask him how they derived those factors.

You are correct that these were the only remaining issues for me, except the protocol Appendix B ash loading issue I added in the May 25 e-mail. Dave Shea told me by phone he would look into that this week. We need to wrap this project up, so I'd rather not have to make the additional requests above, but the methodology and inputs in this modeling effort must be something that we can defend on a technical basis as sufficiently valid to support the conclusions derived.

- John

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From: Cramer, David S. [mailto:david.cramer@mirant.com]
Sent: Tuesday, June 14, 2005 12:04 PM
To: McKie,John; McBee,Kenneth
Cc: Shea, Dave; Labrie, Larry A.; Darton,Terry
Subject: RE: Discussion of My Comments on Protocol of 3/24/05 for Mirant Modeling

John and Ken -

I have answers to the few remaining downwash protocol questions that you had, which if I am not mistaken, are items #1 (maximum heat input), #3 (mercury emission rate), and #9 (ash silo emission factors).

Answer to item #1 (maximum heat input):

I reviewed historical data and found the following values are appropriate for use as actual maximum heat input rates, in MBtu/Hr. It should be noted that these values were taken from the CEM system, which calculates boiler heat input reliably, but with a known bias in the stack flow measurement requirements inherent in EPA Method 2. This error typically biases CEM measured flow + 5-10% and also appears in heat input calculations, which use stack flow as an input to the equation.

Unit	Max HI (MBtu/hr)	% Over Rated HI
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#3	1,018	6.0%
#4	1,087	13.2%
#5	1,107	15.2%

Answer to item #3 (mercury emission rate):

Mercury emission rate provided in the protocol is based on reported 2003 TRI mercury emissions, which are available on the EPA website. Mirant used EPRI's Lark-Tripp software to produce the TRI report in 2003. In the report, there is a statement of basis for mercury emission estimates, quoted here:

"In 1998, EPA issued an Information Collection Request (ICR) under authority of Section 114 of the Clean Air Act, for mercury coal data and mercury speciation in flue gas streams. As part of the ICR, 84 power

plants were required to conduct mercury speciation stack sampling. EPRI used the results from the ICR stack tests to develop predictive relationships for mercury removal across particulate and SO2 control devices, as well as the form of mercury emitted. These correlations are described in more detail in *An Assessment of Mercury Emissions from U.S. Coal-Fired Power Plants*, EPRI, Report 1000608.

To assist power plants in responding to TRI reporting requirements, the mercury calculational methodology is summarized in *Estimation Methodology for Total and Elemental Mercury Emissions from Coal-Fired Power Plants* (EPRI Report 1001327). These correlations are suggested for use in estimating total and elemental mercury emissions, and are expected to provide a more technically sound estimate than the average removals summarized in the 1995 version of the *Emission Factors Handbook* (1995)."

To illustrate how the average value was arrived upon, I have included the following calculation below:

2003 Po River Coal Burned (lbs):	2,046,312,000	(a)
Coal HHV (Btu/lb):	13,096	(b)
Total Heat Input from Coal (Btu):	26,798,501,952,000	(c) = (a*b)
TRI Hg Emitted to Air (lbs):	71	(d)
Hg Emission Rate (lb/TBtu):	2.65	(e) = (d/c)

Admittedly, the value I came up with is slightly different from the 2.53 lb/TBtu value given previously, but we are in the same ballpark here, and I am willing to use the higher number.

Answer to item #9 (ash silo emission factors):

Larry Labrie spoke with Ray Porter of CH2MHill, concerning the particulate matter (PM) emission factors used for the bottom ash and fly ash silos in the PM emission inventory developed by CH2MHILL. The emission factors used to compute PM emission rates for the the bottom ash and fly ash silos are 0.1 grains/acf and 0.015 grains/acf, respectively. These PM emission factors are based on CH2MHILL's engineering judgment as representative of emissions from baghouse controls (99% removal efficiency) on ash silos.

During my historical data search, I found stack temperatures and velocities to be in range with those previously provided, therefore I am not offering any revisions to values used in the protocol.

Dave Cramer

Manager - Air Compliance & Permitting

Mirant Corp. - East Region

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From: McKie,John [mailto:jrmckie@deq.virginia.gov]
Sent: Monday, May 16, 2005 5:46 PM
To: McBee,Kenneth
Cc: Shea, Dave; Labrie, Larry A.; Darton,Terry; Cramer, David S.
Subject: Discussion of My Comments on Protocol of 3/24/05 for Mirant Modeling

Ken,

This afternoon Dave Shea of ENSR, Dave Cramer and Larry Labrie of Mirant, and I participated in a conference call to discuss most of the comments I sent to you (which you subsequently e-mailed to Dave Shea) regarding the protocol, dated March 24, 2005, for the Mirant modeling of emissions to the air from the Potomac River Generating Station (PRGS). I have attached those comments for your convenience. We discussed all of the comments, except those that you and Terry agreed that you would handle; i.e., comments 13, 19, and 21. The following is a list, by comment number, of the actions that were agreed to. I request that the other participants in the conference call please let me, Ken McBee, and the others know if you believe I have misstated any of the proceedings.

1. Similar to the way that maximum CO rates were determined, Dave Cramer will search a few years of measured heat rates at the PRGS units to determine maximum likely heat rates. The heat rates are occasionally, but not normally, greater than the original design heat rates.

2. DEQ accepts the CO rates.

3. The hourly mercury emission rates were based on the maximum heat rates, but on an average emission factor. Mirant/ENSR will, at my suggestion, look at some way to account for the likelihood that the maximum actual hourly emission rates are greater than the rates based on an average emission factor. In addition, although we did not agree to this, I am also requesting by this e-mail that Mirant/ENSR show the calculations and provide a copy of the relevant TRI page, or state a specific way (e.g., give a webpage URL) for DEQ/public to view the data in the TRI, upon which the calculations are based.

4. The stack parameter variables in Table 2-1 are based on CEM data. The protocol should state that.

5. DEQ accepts the silo data.

6. The heights in Table 2-2 are based on conservatively low engineering judgment

estimates. The coal pile height assumes half the average height. The protocol needs to state this.

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John R. McKie, P.E.

Air Permits Group

Northern Virginia Regional Office

Virginia Dept. of Environmental Quality

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Phone: (703) 583-3831

E-mail: jrmckie@deq.virginia.gov

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COMMONWEALTH of VIRGINIA

W. Tayloe Murphy, Jr.
Secretary of Natural Resources

DEPARTMENT OF ENVIRONMENTAL QUALITY
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Robert G. Burnley
Director

(804) 698-4000
1-800-592-5482

June 17, 2005

Mr. David Shea
Project Manager
ENSR
2 Technology Park Drive
Westford, MA 01886

Dear Mr. Shea:

First of all, thank you for meeting the approved deadline extension for the modified Protocol for Downwash Modeling-Mirant Potomac River, LLC. I shared the extra copies of the protocol with the interested parties in Alexandria as a courtesy and received comments that have been evaluated. The comments are addressed for the most part in this letter. As to the electronic media containing the modeling files, an additional copy will be necessary for the public comment process.

The modified protocol satisfies the Department of Environmental Quality's (DEQ) original concerns with the exception of one matter concerning the receptor grid. In order for your final analysis to be accepted as complete, the predicted concentration of any receptor in the coarse grid (1-5 km) that either causes a predicted violation of the National Ambient Air Quality Standards (NAAQS) or results in the maximum concentration without exceeding the NAAQS must be remodeled in a more refined mode, i.e., 100 meter discrete receptor spacing out to 500 meters in each direction.

The most recent version of the AERMOD model along with BPIPPRM (Building Profile Input Program for PRIME) as listed in SCRAM should be used for the analysis. The most recent version is the one that will be promulgated in the near future. Also, the meteorological data referenced in the protocol is appropriate and approved for this analysis.

As stated in the original protocol letter, PM_{10} will be analyzed as a surrogate for $PM_{2.5}$ as per EPA guidance.

All agreed to emissions and stack parameters data comments (after evaluation of the outside comments and incorporation of the concurrence items into DEQ's response) have been discussed and resolved and will be addressed in your final analysis report.

As agreed to, change the 350 degree radial to 360 degrees in sector 3 of the land use map to ensure the envelopment of the Marina Towers building as per the outside commenter. Additionally, add the flagpole receptors to the north of the Marina Towers building as also described by the outside commenter. These comments were also endorsed by the other significant commenter. In addition, review the land use characteristics with respect to changing two sector sizes and addressing the land use comments.

There exists one discrepancy in your background air quality conclusions. The 24 hour value for PM_{10} should be 45 based on another monitor in Fairfax County.

The modified protocol, as further modified by a summary of items above, is approved and all modified and added requirements must be addressed in the final analysis written report as an appendix. Again, thank you for your indulgence since we have spent much time in attempting to satisfy the various comments that DEQ concurred with along with our own comments so that the finalized requirements and clarifications would be addressed in your analysis submittal that is due according to the requirements of the Consent Order.

Sincerely,

Kenneth L. McBee
Air Quality Modeler

Cc: Tamera Thompson, Director, OAPP, DEQ
Terry Darton, Air Permitting Manager, NVRO
John McKie, Air Permitting Engineer, NVRO
David Cramer, Mirant Corp
Larry Labrie, Mirant Corp

Shea, Dave

From: McKie,John [jrmckie@deq.virginia.gov]
Sent: Tuesday, June 21, 2005 5:24 PM
To: Cramer, David S.
Cc: McBee,Kenneth; Shea, Dave; Labrie, Larry A.
Subject: RE: Discussion of My Comments on Protocol of 3/24/05 for Mirant Modeling

Dave,

As you may be aware from your incoming voice mail, I have tried to phone you regarding the mercury issue, because I believe we might more expeditiously come to an agreement through conversation. I am sending you this to better prepare you for such a conversation.

1) You say that average data for PRGS coal burned ranges between 4.6 and 5.4 lb/TBtu. I would like to know what this really represents and how you determined it. Is this information that was gathered in your own lab using some recognized sampling method? If not, then how was it determined? Is it really the range of an "average"? If so, an average of what? Or is it really the high and low range for all the data and the average is something between 4.6 and 5.4? In either case, approximately what sort of sampling frequency and period are we talking about? Does it represent one lump of coal from the coal pile removed during each of the past two years or is it more like hourly samples of the as-burned coal over the past ten years?

2) I have no problem with using a conservative estimate of mercury emissions control efficiency based on "industry experience," so long as there is something in writing that you can cite, which I can cite when asked about it. My concern over the variability in potential mercury (Hg) emissions has been due to the considerable (orders of magnitude) variability in the mercury concentration found in bituminous coals. We want to be able to assure concerned citizens that the modeling uses an emission rate based on a Hg concentration in the coal that will seldom, if ever, be exceeded at PRGS. If 5.4 lb/TBtu is that concentration, then I am fine with multiplying that by 0.8 to account for some control, just as you have proposed (so long as I have a citation for the 0.8).

3) I don't want to split the difference between the results of my method and any other possible method, because my method is simply a last resort. Presumably, any other method would be better.

Please phone me about this by the end of Wednesday (June 22), if at all possible. I spoke directly with the Director of DEQ today and he wants defensible inputs to the model, but wants this wrapped up ASAP.

- John

-----Original Message-----
From: Cramer, David S. [mailto:david.cramer@mirant.com]
Sent: Friday, June 17, 2005 4:56 PM
To: McKie,John
Cc: McBee,Kenneth; Dave Shea; Labrie, Larry A.
Subject: RE: Discussion of My Comments on Protocol of 3/24/05 for Mirant Modeling

John -

I apologize for the delay in answering your questions - I was out of town yesterday.

One thing we do have is some history on mercury content in the coal burned at the plant. Average data ranges between 4.6 and 5.4 lb/TBtu (~0.06-0.07 ppm). Whatever value we select, I would hope we could agree on making it no greater than the coal input value. The quote from Steve Arabia was based on this source coal data, as the Chalk Point, Morgantown, and Dickerson coal typically contains 10.5 - 17.0 lb/TBtu of Hg. I see two approaches to selecting the Hg number - the method you describe John, or pick a conservative level of reduction based on industry experience for units with hot and cold precipitators, say 20%, even though the Lark-Tripp TRI program uses a value closer to 40%. Your method comes up with 5.3 lb/TBtu and mine comes up with 4.3 (5.4 x .8). Split the difference?

Dave C.

-----Original Message-----
From: McKie,John [mailto:jrmckie@deq.virginia.gov]
Sent: Thursday, June 16, 2005 11:11 AM
To: Cramer, David S.
Cc: McBee,Kenneth; Dave Shea; Labrie, Larry A.
Subject: RE: Discussion of My Comments on Protocol of 3/24/05 for Mirant Modeling

Dave,

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Answer to item #1 (maximum heat input):

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Hg Emission Rate (lb/TBtu): = (d/c)	2.65	(e)

Admittedly, the value I came up with is slightly different from the 2.53 lb/TBtu value given previously, but we are in the same ballpark here, and I am willing to use the higher number.

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Manager - Air Compliance & Permitting

Mirant Corp. - East Region

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To: McBee,Kenneth
Cc: Shea, Dave; Labrie, Larry A.; Darton,Terry; Cramer, David S.
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5. DEQ accepts the silo data.

6. The heights in Table 2-2 are based on conservatively low engineering judgment estimates. The coal pile height assumes half the average height. The protocol needs to state this.

7. The comment that Appendix B needs more illustrative calculations is a general comment. Mirant/ENSR were advised of some specific instances where more calculations should be shown as we went along.

8. ENSR will provide some examples of real data to support their contention that the assumption of 0.1 grains/acf at the baghouse outlet for the flyash silos is conservative.

9. CH2M-Hill made the emissions estimates. Mirant/ENSR will ask them for specifics on how they did it and put those in the protocol.

10. ENSR based their calculations on the coal pile covering 4 acres. CH2M-Hill had used 6 acres. Dave Cramer says that 4 acres is the maximum, but that additional area may be covered in coal dust, giving the effect of a larger pile when viewed from the air. The protocol should be clarified to prevent confusion about the "6 acres."

11. The equation is actually as I assumed. This will be corrected in the protocol.

12. The protocol will reflect that a dust suppressant is used on the coal pile, and that, if anything, it means that the equation overestimates fugitive emissions.

13. To be resolved by Mirant/ENSR with Ken McBee.

14. The railcar dumper calculations are for both the existing setup and how it will be modified in the future. The calculations should be laid out to make this clear.

15. ENSR will send me their detailed calculations for the railcar dumper emissions, so that I may determine why my results do not match theirs.

16. The protocol will be revised to show that the equation used for trucks is Equation 1 from AP-42, Section 13.2.1.3 of AP-42.

17. The average truck weight will be corrected to 21 tons.

18. ENSR believes, despite my doubts, that the assumption of 1 g/m^3 of silt on the pavement is valid. The protocol must have a citation to support the assumption.

19. To be resolved by Mirant/ENSR with Ken McBee.

20. The protocol will be revised to show that the equation(s) used for calculating the coal pile emissions already account for the other processes mentioned in my comment.

21. To be resolved by Mirant/ENSR with Ken McBee.

John R. McKie, P.E.

Air Permits Group

Northern Virginia Regional Office

Virginia Dept. of Environmental Quality

13901 Crown Court

Woodbridge, VA 22192

Phone: (703) 583-3831

E-mail: jrmckie@deq.virginia.gov

<<Comments on Mirant Modeling Protocol of 3-24-05.doc>>

Shea, Dave

From: Cramer, David S. [david.cramer@mirant.com]
ent: Wednesday, June 22, 2005 5:06 PM
o: John McKie (E-mail)
Cc: Shea, Dave; Labrie, Larry A.; Solomon, Arnold L.
Subject: Potomac River Coal Mercury Content

Po River Coal
lercury Content .

John -

Following up on our phone conversation from earlier today, I am attaching tables of mercury content in coal that was burned at Potomac River in 1999. This data was compiled as a part of the EPA Information Collection Request (ICR) for coal-fired electric utility mercury data. The ICR required mercury and chlorine analysis of every sixth train delivery to the station throughout the year. There are a total of 47 samples reported in this summary, with mine names and shipping dates included. I also have copies of all the lab analysis reports used to build the summary tables. I selected one analysis from each quarter, from different mines to provide backup to the summary data.

As I mentioned on the phone, only a handful of Appalachian coal suppliers can meet the low sulfur content coal specification at Potomac River. This being the case, the mines that deliver coal to the station do not vary much from year to year. I know that we still buy coal from Mingo Logan and Pittsdon Moss #3 today. The highest individual train mercury content in this data set is 0.10 ppm, equivalent to 7.70 lb/TBtu Hg content (using coal heating value of 13,000 Btu/lb). The average value is 0.056 ppm, equivalent to 4.31 b/TBtu Hg content.

As you suggest, we will include this background information in the final modeling report, to provide a defensible basis for data used in the modeling process.

Please give me a call if you would like to discuss this data further.

Dave Cramer
301-669-8168

<<Po River Coal Mercury Content (1999 ICR Data).pdf>>

MERCURY & CHLORINE ANALYSIS REPORT
JANUARY MARCH 1999

STATION	SHIPPER	UNIT TRAIN #	SHIPPING DATE	MERCURY	CHLORINE	
POTOMAC	MINGO LOGAN	M8002	01/01/99	0.04	0.17	
POTOMAC	MINGO LOGAN	M8002	01/08/99	0.06	0.15	
POTOMAC	COLONIAL	C8154	01/09/99	0.06	0.18	
POTOMAC	COLONIAL	C8154	01/01/99	0.06	0.19	
POTOMAC	MINGO LOGAN	M8002	01/09/99	0.03	0.14	
POTOMAC	PITTS/MOSS#3	M8001	01/20/99	0.06	0.08	*
POTOMAC	COLONIAL	C8154	02/02/99	0.06	0.15	
POTOMAC	ROCKY HOLLOW	R8006	02/16/99	0.08	0.22	
POTOMAC	ROCKY HOLLOW	R8006	02/15/99	0.06	0.25	
POTOMAC	COLONIAL	C8154	02/22/99	0.06	0.15	
POTOMAC	COLONIAL	C8154	02/09/99	0.05	0.09	
POTOMAC	COLONIAL	C8154	02/24/99	0.09	0.10	
POTOMAC	COLONIAL	C8154	03/02/99	0.07	0.14	
POTOMAC	MINGO LOGAN	M8002	03/17/99	0.08	0.10	

* = ANALYSIS ATTACHED

MERCURY & CHLORINE ANALYSIS REPORT
APRIL JUNE 1999

STATION	SHIPPER	UNIT TRAIN #	SHIPPING DATE	MERCURY	CHLORINE	
POTOMAC	MINGO LOGAN	M8002	04/06/99	0.05	0.1500	
POTOMAC	MINGO LOGAN	M8002	04/21/99	0.05	0.1500	*
POTOMAC	COLONIAL	C8154	04/01/99	0.05	0.1100	
POTOMAC	COLONIAL	C8154	05/10/99	0.10	0.1400	
POTOMAC	MINGO LOGAN	M8002	05/15/99	0.04	0.1700	
POTOMAC	MINGO LOGAN	M8002	05/26/99	0.04	0.1700	
POTOMAC	COLONIAL	C8154	05/29/99	0.06	0.1400	
POTOMAC	WINIFREDE	W8043	06/08/99	0.06	0.0972	
POTOMAC	MINGO LOGAN	M8002	06/15/99	0.06	0.1400	
POTOMAC	COLONIAL	C8154	06/21/99	0.06	0.1500	

* ANALYSIS ATTACHED

MERCURY & CHLORINE ANALYSIS REPORT
JULY – SEPTEMBER 1999

STATION	SHIPPER	UNIT TRAIN #	SHIPPING DATE	MERCURY DRY PPM	CHLORINE DRY %	
POTOMAC RIVER	WINIFREDE	7/7/99	7/7/99	0.07	0.1157	
POTOMAC RIVER	MOSS #3	7/14/99	7/14/99	0.06	0.0800	
POTOMAC RIVER	COLONIAL	7/22/99	7/22/99	0.07	0.1700	
POTOMAC RIVER	WELLMORE	7/23/99	7/23/99	0.05	0.0900	
POTOMAC RIVER	MOSS #3	8/5/99	8/5/99	0.04	0.0800	
POTOMAC RIVER	MOSS #3	8/13/99	8/13/99	0.04	0.0800	
POTOMAC RIVER	WINIFREDE	8/23/99	8/23/99	0.06	0.1040	
POTOMAC RIVER	COLONIAL	8/31/99	8/31/99	0.08	0.1600	
POTOMAC RIVER	WINIFREDE	9/7/99	9/7/99	0.03	0.1318	*
POTOMAC RIVER	COLONIAL	9/9/99	9/9/99	0.06	0.1300	
POTOMAC RIVER	COLONIAL	9/21/99	9/21/99	0.05	0.1600	
POTOMAC RIVER	WINIFREDE	9/21/99	9/21/99	0.03	0.1307	

* = ANALYSIS ATTACHED

MERCURY & CHLORINE ANALYSIS REPORT
OCTOBER - DECEMBER 1999

STATION	SHIPPER	UNIT TRAIN #	SHIPPING DATE	MERCURY DRY PPM	CHLORINE DRY %	
POTOMAC RIVER	COLONIAL	10/6/99	10/6/99	0.06	0.1500	
POTOMAC RIVER	WINIFREDE	10/14/99	10/14/99	0.05	0.1353	
POTOMAC RIVER	COLONIAL	10/21/99	10/21/99	0.05	0.1400	
POTOMAC RIVER	COLONIAL	11/2/99	11/2/99	0.06	0.1600	
POTOMAC RIVER	WINIFREDE	11/10/99	11/10/99	0.06	0.1035	
POTOMAC RIVER	WINIFREDE	11/15/99	11/15/99	0.02	0.1078	
POTOMAC RIVER	WINIFREDE	12/1/99	12/1/99	0.01	0.1247	
POTOMAC RIVER	COLONIAL	12/7/99	12/7/99	0.05	0.1300	
POTOMAC RIVER	WELLMORE	12/13/99	12/13/99	0.05	0.0800	
POTOMAC RIVER	COLONIAL	12/18/99	12/18/99	0.07	0.1500	*
POTOMAC RIVER	MOSS #3	12/21/99	12/21/99	0.08	0.0700	

* = ANALYSIS ATTACHED

COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 1919 SOUTH HIGHLAND AVE., SUITE 210-B, LOMBARD, ILLINOIS 60148 • TEL: 630-953-9300 FAX: 630-953-9306

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Member of the SGS Group (Société Générale de Surveillance)

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ADDRESS ALL CORRESPONDENCE TO:
P.O. BOX 32
CHARLEROI, PA 15022
TEL: (724) 483-3549
FAX: (724) 483-0892

February 19 1999

POTOMAC ELECTRIC POWER COMPANY
PRODUCTION SERVICE CENTER
8711 WESTPHALIA ROAD
UPPER MARLBORO MD 20774
MIKE ROBERTSON
MIKE ROBERTSON

Sample identification by
POTOMAC ELECTRIC POWER COMPANY

95-990129-034 1 1/20/99

PITTS / MOSS #3 / Mine #(M8001)

Kind of sample COAL SAMPLE
reported to us

Sample taken at

Sample taken by SUBMITTED

Date sampled January 29 1999

Date received February 7, 1999

Analysis Report No 43-274197

MERCURY IN COAL (DRY PPM)	0.06
CHLORINE IN COAL DRY WT%	0.08

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Charleroi Laboratory

MEMBER ACIL

COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 1919 SOUTH HIGHLAND AVE., SUITE 210-B, LOMBARD, ILLINOIS 60148 • TEL: 630-953-9300 FAX: 630-953-9306

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ADDRESS ALL CORRESPONDENCE TO:
P.O. BOX 2721
PIKEVILLE, KY 41502
TEL: (606) 432-2511
FAX: (606) 437-4657

April 29, 1999

POTOMAC ELECTRIC POWER CO
Generation Fuels
1900 Penn. Ave., NW
Washington DC 20068
R.M. Robertson

Sample identification by
Mingo Logan

Sample ID

Transportation Contract No. C-8533
99 railcars on file
Technicial: CH

SHIPPER - Southeast Fuels

P.O. No. CC837312-000-00-GG

(picked up sample)

Kind of sample reported to us Coal

Sample taken at Mingo Logan (1865)

Sample taken by Mechanical

Date sampled April 21, 1999

Date received April 22, 1999

Analysis report no. 48-77246

PARAMETER	RESULTS
Mercury, Hg	0.05 ppm
Chloride, Cl	1500 ppm

STANDARD - .106
RESULTS - .103

Procedure The sample was prepared according to ASTM, Part 05.05, Method D 3683. The sample was analyzed for trace elements by Inductively Coupled Plasma Emission Spectroscopy. Mercury was determined by Manual Coal Vapor Atomic Absorption.

Results: Results are reported in parts per million (ppm)

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Richard P. Malcolm II

Pikeville Laboratory

MEMBER ACIL

COMMERCIAL TESTING & ENGINEERING CO.
GENERAL OFFICES: 1919 SOUTH HIGHLAND AVE., SUITE 210-B, LOMBARD, ILLINOIS 60148 • TEL: 630-953-8300 FAX: 630-953-8306

SGS Member of the SGS Group (Société Générale de Surveillance)

ADDRESS ALL CORRESPONDENCE TO:
P.O. BOX 850
SOPHIA, WV 25921
TEL: (304) 255-0422
FAX: (304) 255-0417

October 6, 1999

Potomac Electric Power Company
1900 Pennsylvania Avenue
Northwest Washington DC 20068

Sample identification by
Pioneer Fuel Corp.

Train 34 - 50 Cars CR: 505103
N&S: 36240, 28563, 23640, 42810, 42239
N&S: 44678, 28976, 34759, 34709, 40816
N&S: 34869, 32535, 25849, 21833, 30229
N&S: 36284, 27550, 29901, 28905, 26337
N&S: 34500, 36232, 32278, 25913, 22715
N&S: 27905, 39093, 25344, 32307, 39000
N&S: 32633, 22489, 38515, 32070, 39802
N&S: 30196, 32625, 39827, 29578, 26330
N&S: 35199, 23646, 21491, 30670, 26553
N&S: 41853, 39325, CR: 507528, 505894
Sample picked up at Standard Laboratory
on Sept. 8, 1999 (PO#CC837322-000-00 CC)

Kind of sample reported to us: Coal

Sample taken at: Pioneer Fuel Corp

Sample taken by: Standard Laboratory

Date sampled: September 7, 1999

Date received: September 8, 1999

Analysis report no. 64-99009657

MERCURY IN COAL (Dry, ppm) = 0.03

CHLORINE IN COAL (Dry, ppm) = 1318

METHODS
Mercury: ASTM D 3684-94
Chlorine: ASTM D 4208-88 (1993)

Mercury Standard Run Results (ppm): 0.105
Mercury Std Source and Concentration: NIST 1630a .106 ppm ± 0.023 ppm

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.
Edward J. Reed
Beckley Laboratory

MEMBER ACIL

COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 1919 SOUTH HIGHLAND AVE., SUITE 210-B, LOMBARD, ILLINOIS 60148 • TEL: 630-953-9300 FAX: 630-953-9306

SINCE 1896

SGS Member of the SGS Group (Société Générale de Surveillance)

ADDRESS ALL CORRESPONDENCE TO:
P.O. BOX 2721
PIKEVILLE, KY 41502
TEL: (606) 432-2511
FAX: (606) 437-4857

January 5, 2000

POTOMAC ELECTRIC POWER CO
Generation Fuels
1900 Penn. Ave., NW
Washington DC 20068
R.M. Robertson

Sample identification by
Point Rock

SAMPLE ID

Kind of sample reported to us: Coal

Sample taken at: Pointrock

Sample taken by: Mechanical

Date sampled: December 18, 1999

Date received: December 18, 1999

Contract No. C-8533
64 railcars on file
Technician: DF

SHIPPER - Lodestar

P.O. No C837312-000-00-GG

(picked up sample)

Analysis report no. 46-89024

PARAMETER	RESULTS
Mercury, Hg	0.07 ppm
Chloride, Cl	1500 ppm

STANDARD - .106
RESULTS - .10

Procedure: The sample was prepared according to ASTM, Part 05.05, Method D 3683. The sample was analyzed for trace elements by Inductively Coupled Plasma Emission Spectroscopy. Mercury was determined by Manual Coal Vapor Atomic Absorption.

Results: Results are reported in parts per million (ppm).

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

MEMBER ACIL

Pikeville Laboratory

Shea, Dave

From: McKie,John [jrmckie@deq.virginia.gov]
t: Thursday, June 23, 2005 12:14 PM
To: Cramer, David S.
Cc: Shea, Dave; Labrie, Larry A.; Solomon, Arnold L.; McBee,Kenneth
Subject: RE: Potomac River Coal Mercury Content; Silo Emissions

Dave,

Mercury Content

Thanks for the documentation. Everything looks good. There are plenty of data here to support a determination of mercury emission rates for modeling. I request that you use emission rates in your modeling effort that correspond to 7.70 lb/TBtu for "short-term" (hourly, daily, etc. averaging periods) modeling and 4.31 lb/TBtu or greater for annual average modeling. I checked your conversion from ppm, but did not check your calculation of the average ppm. However, by inspection, it appears that 0.056 ppm is reasonable. I expressed concern in our phone conversation that the average should be weighted according to which mine is used the most. However, it appears that their average values are sufficiently similar that the weighting issue is unimportant, especially given that the mix of coals being fired at Potomac River in 2005, and especially in 2010, may be different than in 1999. Be sure to address the issue of similarity of coal in 1999 with that of now and the near future in your final report.

As I've said before, I'll approve the use of 20% reduction factor for control due to the ESP's and fallout if you supply a citation to support that number, but my opinion is the 20% reduction is more likely to raise a "red flag" than it is likely to yield a result that will show you in compliance when you otherwise would not be. I leave this to your discretion.

Silo Emissions

I have read the e-mail from David Shea, ENSR, sent today regarding emissions from the fabric filters on the ash silos. All the specs I have seen for silo dust fabric filters (and I've seen several this year) are for percent control efficiency, usually at least 99.99 percent. None say anything about the actual concentration at the outlet, because that is too dependent on the silo and its type of operation; i.e., a dustier operation yields more grains per cf. However, it does appear from the table that David submitted that if there are any, there certainly must not be many silo fabric filters that are permitted with outlet rates in excess of 0.015 gr/scf. With that documentation as my support, I accept the use of 0.02 gr/dscf , which somewhat accounts for the possibility that the PRGS silos are dirtier than the ones reflected in David's BACT limits table.

John R. McKie, P.E.

Air Permits Group

Northern Virginia Regional Office

Virginia Dept. of Environmental Quality

13901 Crown Court

lbridge, VA 22192

Phone: (703) 583-3831

E-mail: jrmckie@deq.virginia.gov

-----Original Message-----
From: Cramer, David S. [mailto:david.cramer@mirant.com]
Sent: Wednesday, June 22, 2005 5:06 PM
To: McKie,John
Cc: David Shea (E-mail); Labrie, Larry A.; Solomon, Arnold L.
Subject: Potomac River Coal Mercury Content

John -

Following up on our phone conversation from earlier today, I am attaching tables of mercury content in coal that was burned at Potomac River in 1999. This data was compiled as a part of the EPA Information Collection Request (ICR) for coal-fired electric utility mercury data. The ICR required mercury and chlorine analysis of every sixth train delivery to the station throughout the year. There are a total of 47 samples reported in this summary, with mine names and shipping dates included. I also have copies of all the lab analysis reports used to build the summary tables. I selected one analysis from each quarter, from different mines to provide backup to the summary data.

As I mentioned on the phone, only a handful of Appalachian coal suppliers can meet the low sulfur content coal specification at Potomac River. This being the case, the mines that deliver coal to the station do not vary much from year to year. I know that we still buy coal from Mingo Logan and Pittsdon Moss #3 today. The highest individual train mercury content in this data set is 0.10 ppm, equivalent to 7.70 lb/TBtu Hg content (using coal heating value of 13,000 Btu/lb). The average value is 0.056 ppm, equivalent to 4.31 lb/TBtu Hg content.

As you suggest, we will include this background information in the final modeling report, to provide a defensible basis for data used in the modeling process.

Please give me a call if you would like to discuss this data further.

Dave Cramer

301-669-8168

<<Po River Coal Mercury Content (1999 ICR Data).pdf>>

APPENDIX B

PARTICULATE EMISSION CALCULATIONS

MIRANT POTOMAC RIVER GENERATING STATION

Mirant Potomac River, LLC
Emission Estimates Summary for Fugitive Dust

Fugitive Dust Emissions Source	Existing Emissions				
	---PM-10---			--- Total PM ---	
	lb/hr	g/sec	tpy	lb/hr	tpy
Ash Silo Vent Secondary Filtration (Page B-2)	2.26	0.285	9.9	2.26	9.9
Ash Loader (Page B-3)	0.05	0.006	0.04	0.11	0.07
Resuspended Roadway Dust from Ash Trucks (Page B-4)	0.60	0.076	1.22	-	-
Coal Pile Wind Erosion (Page B-5)	0.93	0.118	1.12	1.94	2.32
Coal Stackout Conveyor System (Page B-6)	0.05	0.006	0.20	0.10	0.42
Railcar Dumper (Page B-7)	0.12	0.016	0.06	0.26	0.14

Mirant Potomac River, LLC
Ash Silo Vent Secondary Filtration - Fugitive Dust Emission Calculations

FLY ASH EMISSION CALCULATIONS - EXISTING EMISSIONS

Fly Ash Assumptions

Total Ash Shipped in trucks =	631	tpd (according to Mirant)			164,060 ton ash/yr
Est. Fly ash shipped in trucks =	593				
Est. Bottom ash shipped in trucks=	38				
Target moisture for fly ash	20	%			
Worse case moisture for fly ash=	10	%			
Daily Ash generated by Boilers	480	tpd			
Estimated % that is bottom ash	6%				
Estimated % that is fly ash	94%				
Estimated Avg wt of ash in trucks	22	tons @	20%	moisture	
Truck Loading in Silo:	8	min			
Truck Washing	15 - 30	min			
Ash hauling	8	hr/day			
	5	days/wk			
	52	wk/yr	260	days/yr	
Trucks onsite	4	hr/day			
Avg number of trucks hauling ash	7	trucks/day	7,280	truck trips/yr	160,160 ton ash/yr
Avg number of truck trips	4	trips/day			
Peak number of trucks hauling ash	10	trucks/day	40	truck trips/day	
Peak number of truck trips	4	trips/day			

Fly Ash Emissions from Baghouse on top of loading silos

2 - Silo's	Flow of pneumatic air with fly ash into silo	7800	cfm (Mirant - 2 x (2,700 + 1,200)
	Ash Loading into silo	480	tpd (from daily ash generated by boilers)
	Baghouse collection efficiency	99.8%	(based on outlet grain loading)
	Outlet Baghouse emissions (assumed)	0.02	grains/acf
	Estimated PM/PM-10 emissions	156	grains/min
	Estimated PM/PM-10 hourly emissions	1.34	lb/hr
	Estimated PM/PM-10 yearly emissions	5.86	tpy

Example Calculation: PM/PM-10 emissions (lb/hr) = 7800 cfm x 0.1 grains/acf / 7000 grains per pound x 60 min/hr

Bottom Ash Emissions from Baghouse on top of loading silo

1 - Silo	Flow of pneumatic air with fly ash into silo	5400	cfm (from Mirant)
	Outlet Baghouse emissions (assumed)	0.02	grains/acf (assumed based on visual comparison to fly ash silo baghouses)
	Estimated PM/PM-10 emissions	108	grains/min
	Estimated PM/PM-10 hourly emissions	0.93	lb/hr
	Estimated PM/PM-10 yearly emissions	4.05	tpy

Example Calculation: PM/PM10 emissions (lb/hr) = 5400 cfm x 0.02 grains/acf / 7000 grains per pound x 60 min/hr

Total Ash Emissions (All three silos)

	---PM-10 Emissions---		---PM Emissions---	
	lb/hr	tpy	lb/hr	tpy
Ash Silo Secondary Filtration	2.3	9.9	2.3	9.9

by 1/1/06 2 fly ash silo vents to be ducted into unit's hot precip

not taking credit for this in modeling

Mirant Potomac River, LLC
Ash Loader - Fugitive Dust Emission Calculations

FLY ASH EMISSION CALCULATIONS

Fly Ash Emissions from Truck Loading in Silos

	PM10		PM	
Existing Peak Estimate	2.17E-04	EF lb/ton	4.58E-04	EF lb/ton
	880	tpd fly ash loaded	880	tpd fly ash loaded
	236	tph fly ash loaded	236	tph fly ash loaded
	0.051	lbs/hr fly ash emissions	0.108	lbs/hr fly ash emissions
	0.035	tpy fly ash emissions	0.075	tpy fly ash emissions

Emission Factor Calculations (1)

UEF PM (lb/ton) = k x 0.0032 x ((U/5)^1.3)/((M/2)^1.4)

Example calculation (lb/hr fly ash emissions) = uncontrolled emission factor (UEF) x tph fly ash loaded

UEF = 0.35 x 0.0032 x $((8mph/5)^{1.3} / ((10\%/2)^{1.4})$

UEF = 2.17E-04 lb/ton

fly ash emissions (lb/hr) = 2.17E-04 x 236 tph = 0.051 lbs/hr PM-10

modeling assumes no controls
Future plans ~~to~~ will control

Assume:

k (particle size multiplier) =	0.35	for PM-10 &	0.74 for PM
U (mean wind speed) =	8	miles/hour average wind speed within the silo enclosures (assumed)	
M (moisture content) =	20	% (target moisture content of fly ash after pug mill)	
M (moisture content) =	10	% (worse case moisture content of fly ash after pug mill)	
Emission control removal efficiency =	0	%	No collection from truck loading

Existing Peak	
UEF PM-10 Emission Factor =	2.17E-04
CEF PM-10 Emission Factor =	2.17E-04
UEF PM Emission Factor =	4.58E-04
CEF PM Emission Factor =	4.58E-04

NOTES:

'(1) AP-42 Section 13.2.4 Aggregate Handling and Storage Piles

Fly Ash Assumptions

Total Ash Shipped in trucks =	631	tpd (according to Mirant)	
Est. Fly ash shipped in trucks =	593		
Est. Bottom ash shipped in trucks=	38		
Target moisture for fly ash	20	%	
Worse case moisture for fly ash=	10	%	used in calculation
Daily Ash generated by Boilers	480	tpd	
Estimated % that is bottom ash	6%		
Estimated % that is fly ash	94%		
Estimated Avg wt of ash in trucks	22	tons @	20% moisture
Truck Loading in Silo:	8	min	
Truck Washing	15 - 30	min	
Ash hauling	8	hr/day	
	5	days/wk	
	52	wk/yr	
Trucks onsite	4	hr/day	
Avg number of trucks hauling ash	7	trucks/day	
Avg number of truck trips	4	trips/day	
Peak number of trucks hauling ash	10	trucks/day	
Peak number of truck trips	4	trips/day	

Total Ash Emissions

		---PM-10 Emissions---		---PM Emissions---	
		lb/hr	tpy	lb/hr	tpy
Ash Loader	Existing	0.05	0.04	0.11	0.07

Resuspended Roadway Dust From Ash Trucks

Road Section	Distance	Max. VMT/day	VMT/yr	PM_{10} Emissions			PM_{10} Emissions	
		Round Trip		24 hour	Annual	Annual	24 hour	Annual
	miles			lb/hr	lb/hr	ton/yr	g/s	g/s
From the edge of First Street to the Gate								
Gate to curve	0.177	14.17	2,578.33	0.3570	0.1658	0.7262	0.0450	0.0209
Curve	0.005	0.38	68.94	0.0095	0.0044	0.0194	0.0012	0.0006
Curve to truck scale	0.022	1.74	317.12	0.0439	0.0204	0.0893	0.0055	0.0026
Truck scale to curve	0.028	2.27	413.64	0.0573	0.0266	0.1165	0.0072	0.0034
Curve	0.019	1.52	275.76	0.0382	0.0177	0.0777	0.0048	0.0022
Curve to flyash storage	0.047	3.79	689.39	0.0954	0.0443	0.1942	0.0120	0.0056
Total	0.298	23.86	4,343.18	0.6013	0.2793	1.2233	0.0758	0.0352

	Empty truck wieght	10	ton	Input
	Ash per truck	22	ton	From Mirant
W	Average truck weight	21	ton	Calculated
	Maximum number of truck trips per day	40	trucks/day	From Mirant
	Total truck trips per year	7,280	trucks/yr	Calculated from Mirant data
sL	Silt loading	6.00	g/m^2	Input
C	Emission factor for exhaust brake wear and tire wear	0.00047	lb/VMT	AP-42
k	Particle size multiplier	0.016	lb/VMT	AP-42
P	Annual days with >0.01 inches rain	100	days	113 normal, 100 for a dry year
N	Number of days in the averaging period	365	days	one year

Short term emissions:

$E = k \times (sL/2)^{0.65} \times (W/3)^{1.5} - C$

E = 0.605 lb/VMT

Example calculation (short term emissions [lb/VMT]) = 0.016 lb/VMT x $(6.00/2)^{.65}$ x $(21 \text{ tons}/3)^{1.5}$ - 0.0047 lb/VMT
= 0.605 lb/VMT

Long term emissions:

$E = (k \times (sL/2)^{0.65} \times (W/3)^{1.5} - C) \times (1-P/4N)$ 0.563 lb/VMT

E =0.16 x (6.00)

Example calculation (long term emissions [lb/VMT]) = (0.016 lb/VMT x $(6.00/2)^{.65}$ x $(21 \text{ tons}/3)^{1.5}$ - 0.0047 lb/VMT) - (1-[100/4 x 365])
= 0.563 lb/VMT

Mirant Potomac River, LLC
Coal Pile Wind Erosion - Fugitive Dust Emission Calculations

COAL EMISSIONS CALCULATIONS

Wind Erosion Actual Emissions (for coal emissions)

	---PM-10 Emissions---		---PM Emissions---	
	lb/hr	tpy	lb/hr	tpy
4 acre active coal pile (actual maximum area)	0.93	1.12	1.94	2.32

Wind Erosion

Reference: Control of Open Fugitive Dust Sources, Section 4.1.3, EPA-450/3-98-008
[Wind Emissions From Continuously Active Piles]

E (lb PM per day per acre) = 1.7 (s/1.5) (365-p)/235) (f/15)

where:

s =	4.8	silt content % [from AP-42 Table 13.2.4-1 (coal as received at coal-fired power plant)
p =	100	number of days with >0.01 inches precipitation, 113 normal, 100 for a dry year
Prior to Installation of Windscreen f=	28.4	percentage of time that wind speed exceeds 5.4 m/s at mean pile height [from Washington, DC National Airport wind data 1988-1992]
E =	11.6	lb PM per day per acre
E =	5.8	lb PM-10 per day per acre [using PM-10 to PM ratio of 0.5 from EPA-450/3-98-008]
After Installation of Windscreen f =	27.4	Estimate for percentage of time wind speed exceeds 5.4 m/s after installation of wind screen
E =	11.2	lb PM per day per acre
E =	5.6	lb PM-10 per day per acre [using PM-10 to PM ratio of 0.5 from EPA-450/3-98-008]

Example calculation (lb PM-10/hr) = E x ratio of PM-10/PM x 4 acres / 24 hr/day

E = 1.7 x (4.8/1.5) x (365-100)/235) x (27.4/15) = 11.206 lb PM-10 per day per acre

lb PM-10/hr = 11.206 x 0.5 x 4 acres / 24 hrs/day = 0.9 lb PM-10/hr

✓ taking credit in modeling
wind screens not used early Fall

Mirant Potomac River, LLC
Coal Stack-Out Conveyor System - Fugitive Dust Emission Calculations

COAL EMISSIONS CALCULATIONS

Total Coal Emissions (Peak)

		---PM-10 Emissions---		---PM Emissions---	
		lb/hr	tpy	lb/hr	tpy
Breaker conveyor dump to coal pile	Existing	0.05	0.20	0.10	0.42

Emission Factor Calculations for Coal (1)

UEF PM (lb/ton) = k x 0.0032 x ((U/5)^1.3)/((M/2)^1.4)
CEF PM (lb/ton) = UEF (lb/ton) x ((100 - removal efficiency (%))/100)

Assume:

k (particle size multiplier) =	0.35	for PM-10 &	0.74 for PM
U (mean wind speed) =	12	miles/hour for short term	4.38 miles/hr for annual average
M (moisture content) =	4.5	% (from AP-42 Table 13.2.4-1 for coal as-received at coal fired power plant)	
M (moisture content) =	18	% (based on dust reduction estimate provided by Bob Coburn/ Benetech)	

AVERAGE		***WORSE CASE (PEAK)***	
UEF PM-10 Emission Factor =	3.03E-04	UEF PM-10 Emission Factor =	1.12E-03
CEF PM-10 Emission Factor =	4.35E-05	CEF PM-10 Emission Factor =	1.61E-04
UEF PM Emission Factor =	6.41E-04	UEF PM Emission Factor =	2.37E-03
CEF PM Emission Factor =	9.20E-05	CEF PM Emission Factor =	3.41E-04

Example calculation: UEF PM-10 Emission Factor (lb/ton), Worst Case (peak) =
$= 0.35 \times 0.0032 \times ((12/5)^{1.3} / ((4.5/2)^{1.4}) = 1.12E-03$

NOTES:
'(1) AP-42 Section 13.2.4 Aggregate Handling and Storage Piles

Coal Assumptions

Annual Coal Throughput	711,836	tpy
Hourly Coal Throughput	81	tph (assume coal processed 8760 hr/yr)
Percent of coal throughput to pile	50	% (assume rest goes into storage bunkers in boiler building)

Existing Coal Emissions from Dump to Coal Pile from Breaker (drop from enclosed conveyor onto pile)

	PM10		PM	
Annual	3.03E-04	EF lb/ton	6.41E-04	EF lb/ton
	975	tpd coal dumped on pile	975	tpd coal dumped on pile
	41	tph coal dumped on pile	41	tph coal dumped on pile
	0.012	lbs/hr coal emissions	0.026	lbs/hr coal emissions
	0.054	tpy coal emissions	0.114	tpy coal emissions
	PM10		PM	
Peak Estimate	1.12E-03	EF lb/ton	2.37E-03	EF lb/ton
	975	tpd coal dumped on pile	975	tpd coal dumped on pile
	41	tph coal dumped on pile	41	tph coal dumped on pile
	0.046	lbs/hr coal emissions	0.096	lbs/hr coal emissions
	0.200	tpy coal emissions	0.423	tpy coal emissions

~~Check~~ No control effic. assumed
Controls have been in place for 2 yrs /
no new controls planned

Mirant Potomac River, LLC
Railcar Dumper - Fugitive Dust Emission Calculations

COAL EMISSIONS CALCULATIONS

SUMMARY OF FUGITIVE AND EXISTING PARTICULATE MATTER EMISSIONS FROM COAL

Total Coal Emissions (Peak)

		---PM-10 Emissions---		---PM Emissions---	
		lb/hr	tpy	lb/hr	tpy
Rail Car dump in partial enclosure	Existing	0.12	0.06	0.26	0.14

Rail Car Dump completely enclosed on both sides with heavy duty curtains on either end
Wind speed assumed to be 5 miles/hr. Actual wind speed is less than 5 miles per hour.

Annual Coal Throughput	711,836 tpy	
Hourly Coal Throughput	684 tph	(assume coal dumped 4 hr/day)
Partial Enclosure Control Efficiency	50 %	Control efficiency likely higher than 50%
Daily Coal Unloading	4 hr/day	
Weekly Coal Unloading	5 day/week	
Annual Coal Unloading	52 wk/yr	

Emission Factor Calculations for Coal in Partial Enclosure for Rail Car Dumping (1)

UEF PM (lb/ton) = k x 0.0032 x ((U/5)^1.3)/((M/2)^1.4)
CEF PM (lb/ton) = UEF (lb/ton) x ((100 - removal efficiency (%))/100)

Example calculation: UEF PM-10 Emission Factor (lb/ton), Worst Case (peak) =
$= 0.35 \times 0.0032 \times ((5/5)^{1.3} / ((4.5/2)^{1.4}) = 3.60E\text{-}04$
CEF = 3.60E-04 x ((100 - 50)/100) = 1.80E-04 lb PM-10 per ton

Assume:

k (particle size multiplier) =	0.35	for PM-10 &	0.74	for PM
U (mean wind speed) =	5	miles/hour for short term	5	miles/hr for annual average
M (moisture content) =	4.5	% (from AP-42 Table 13.2.4-1 for coal as-received at coal fired power plant)		

AVERAGE		***WORSE CASE (PEAK)***	
Existing PM-10 Emission Factor =	1.80E-04	Existing PM-10 Emission Factor =	1.80E-04
Existing PM Emission Factor =	3.80E-04	Existing PM Emission Factor =	3.80E-04

NOTES:
'(1) AP-42 Section 13.2.4 Aggregate Handling and Storage Piles

Existing Emissions from Railcar dumper

	PM10		PM	
Annual	1.80E-04	EF lb/ton	3.80E-04	EF lb/ton
	684	tph coal dumped in enclosure	684	tph coal dumped in enclosure
	0.123	lbs/hr coal emissions	0.260	lbs/hr coal emissions
	0.064	tpy coal emissions	0.135	tpy coal emissions

	PM10		PM	
Peak Estimate	1.80E-04	EF lb/ton	3.80E-04	EF lb/ton
	684	tph coal dumped in enclosure	684	tph coal dumped in enclosure
	0.123	lbs/hr coal emissions	0.260	lbs/hr coal emissions
	0.064	tpy coal emissions	0.135	tpy coal emissions

50% control - existing (prior to NOV '05)
After 11/05 water/fogging spray header installed - not taking credit in modeling.

APPENDIX C

GEP BUILDING DIMENSIONS PRODUCED BY LAKES ENVIRONMENTAL BPIP SOFTWARE

MIRANT POTOMAC RIVER, LLC

BPIP Output (meters)

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SO BUILDHGT STACK1     35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT STACK1     35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT STACK1     35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT STACK1     35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT STACK1     35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT STACK1     35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDWID STACK1     36.38   39.88   54.75   68.00   79.00   87.75
SO BUILDWID STACK1     93.75   96.75   97.50   94.50   97.00   97.25
SO BUILDWID STACK1     94.25   88.75   80.75   69.75   56.88   42.34
SO BUILDWID STACK1     36.38   40.00   54.75   68.00   79.00   87.75
SO BUILDWID STACK1     93.75   97.00   97.00   94.50   97.00   97.00
SO BUILDWID STACK1     94.50   88.75   80.75   69.88   56.88   42.31
SO BUILDLEN STACK1    109.50   97.00   97.25   94.50   88.75   80.50
SO BUILDLEN STACK1     69.88   57.00   42.31   26.44   39.88   54.75
SO BUILDLEN STACK1     67.75   79.00   87.75   93.75   97.00   97.00
SO BUILDLEN STACK1    109.00   97.00   97.25   94.50   88.75   80.50
SO BUILDLEN STACK1     69.88   57.00   42.31   26.44   39.88   54.75
SO BUILDLEN STACK1     67.75   78.75   87.75   93.50   96.75   97.00
SO XBADJ    STACK1    -11.50  -10.00   -8.00   -5.75   -3.00   -0.75
SO XBADJ    STACK1      1.88    4.50    6.84    9.00   -4.12  -18.62
SO XBADJ    STACK1    -32.25  -45.25  -56.75  -66.50  -74.50  -80.00
SO XBADJ    STACK1    -97.50  -87.00  -89.50  -88.75  -85.75  -80.00
SO XBADJ    STACK1    -71.75  -61.50  -49.16  -35.47  -35.88  -36.38
SO XBADJ    STACK1    -35.50  -33.75  -31.00  -27.00  -22.50  -17.00
SO YBADJ    STACK1    -17.31  -15.81   -8.88   -1.75    5.75   12.88
SO YBADJ    STACK1     19.62   25.88   31.25   35.75   38.50   40.62
SO YBADJ    STACK1     41.62   41.12   39.62   36.88   32.94   28.02
SO YBADJ    STACK1     17.25   15.88    9.00    1.50   -5.75  -12.88
SO YBADJ    STACK1    -19.62  -25.75  -31.50  -35.75  -38.50  -40.75
SO YBADJ    STACK1    -41.75  -41.38  -39.62  -36.81  -32.94  -28.03

SO BUILDHGT STACK2     35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT STACK2     35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT STACK2     35.29   35.29   35.29   39.60   39.60   39.60
SO BUILDHGT STACK2     35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT STACK2     35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT STACK2     35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDWID STACK2     36.38   39.88   54.75   68.00   79.00   87.75
SO BUILDWID STACK2     93.75   96.75   97.50   94.50   97.00   97.25
SO BUILDWID STACK2     94.25   88.75   80.75   86.12   87.75   95.56
SO BUILDWID STACK2     36.38   40.00   54.75   68.00   79.00   87.75
SO BUILDWID STACK2     93.75   97.00   97.00   94.50   97.00   97.00
SO BUILDWID STACK2     94.50   88.75   80.75   69.88   56.88   42.31
SO BUILDLEN STACK2    109.50   97.00   97.25   94.50   88.75   80.50
SO BUILDLEN STACK2     69.88   57.00   42.31   26.44   39.88   54.75
SO BUILDLEN STACK2     67.75   79.00   87.75  121.75  121.50  117.50
SO BUILDLEN STACK2    109.00   97.00   97.25   94.50   88.75   80.50
SO BUILDLEN STACK2     69.88   57.00   42.31   26.44   39.88   54.75
SO BUILDLEN STACK2     67.75   78.75   87.75   93.50   96.75   97.00
SO XBADJ    STACK2    -36.00  -34.00  -31.00  -27.00  -22.00  -16.50
SO XBADJ    STACK2    -10.50   -4.12    2.34    8.75   -0.12  -10.50
SO XBADJ    STACK2    -20.25  -29.75  -38.25 -307.75 -313.00 -308.50
SO XBADJ    STACK2    -73.00  -62.75  -66.50  -67.50  -67.00  -64.00
SO XBADJ    STACK2    -59.38  -52.88  -44.66  -35.19  -39.75  -44.50
SO XBADJ    STACK2    -47.50  -49.25  -49.50  -48.00  -45.25  -41.00
SO YBADJ    STACK2    -17.03  -19.81  -17.00  -13.75   -9.75   -5.62
SO YBADJ    STACK2     -1.38    2.88    7.25   11.25   14.25   17.62
SO YBADJ    STACK2     20.38   22.38   23.88   27.44  -16.00  -55.09
SO YBADJ    STACK2     16.97   19.88   17.12   13.50    9.75    5.62
SO YBADJ    STACK2      1.38   -3.00   -7.50  -11.25  -14.25  -17.75
SO YBADJ    STACK2    -20.50  -22.62  -23.88  -24.44  -24.31  -23.53
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SO BUILDHGT STACK3     35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT STACK3     35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT STACK3     35.29   35.29   39.60   39.60   39.60   39.60
SO BUILDHGT STACK3     35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT STACK3     35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT STACK3     35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDWID STACK3     36.38   39.88   54.75   68.00   79.00   87.75
SO BUILDWID STACK3     93.75   96.75   97.50   94.50   97.00   97.25
SO BUILDWID STACK3     94.25   88.75   94.50   86.12   87.75   95.56
SO BUILDWID STACK3     36.38   40.00   54.75   68.00   79.00   87.75
SO BUILDWID STACK3     93.75   97.00   97.00   94.50   97.00   97.00
SO BUILDWID STACK3     94.50   88.75   80.75   69.88   56.88   42.31
SO BUILDLEN STACK3    109.50   97.00   97.25   94.50   88.75   80.50
SO BUILDLEN STACK3     69.88   57.00   42.31   26.44   39.88   54.75
SO BUILDLEN STACK3     67.75   79.00  118.50  121.75  121.50  117.50
SO BUILDLEN STACK3    109.00   97.00   97.25   94.50   88.75   80.50
SO BUILDLEN STACK3     69.88   57.00   42.31   26.44   39.88   54.75
SO BUILDLEN STACK3     67.75   78.75   87.75   93.50   96.75   97.00
SO XBADJ    STACK3    -59.00  -56.50  -52.50  -46.75  -39.50  -31.25
SO XBADJ    STACK3    -22.00  -12.00   -1.72    8.66    3.75   -2.75
SO XBADJ    STACK3     -9.00  -15.00 -276.00 -288.00 -291.50 -286.00
SO XBADJ    STACK3    -50.00  -40.25  -45.00  -47.75  -49.25  -49.25
SO XBADJ    STACK3    -47.88  -45.00  -40.59  -35.09  -43.62  -52.12
SO XBADJ    STACK3    -58.75  -63.75  -67.00  -67.75  -66.75  -63.50
SO YBADJ    STACK3    -16.94  -23.69  -24.75  -25.00  -24.25  -23.12
SO YBADJ    STACK3    -21.12  -18.38  -15.25  -11.75   -8.25   -3.88
SO YBADJ    STACK3      0.62    4.88   59.25   15.94  -23.88  -59.16
SO YBADJ    STACK3     16.88   23.75   24.88   24.75   24.25   23.12
SO YBADJ    STACK3     21.12   18.50   15.00   11.75    8.25    3.75
SO YBADJ    STACK3     -0.75   -4.88   -9.12  -12.94  -16.44  -19.47

SO BUILDHGT STACK4     35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT STACK4     35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT STACK4     35.29   35.29   39.60   39.60   39.60   39.60
SO BUILDHGT STACK4     35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT STACK4     35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT STACK4     35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDWID STACK4     36.38   39.88   54.75   68.00   79.00   87.75
SO BUILDWID STACK4     93.75   96.75   97.50   94.50   97.00   97.25
SO BUILDWID STACK4     94.25   88.75   94.50   86.12   87.75   95.56
SO BUILDWID STACK4     36.38   40.00   54.75   68.00   79.00   87.75
SO BUILDWID STACK4     93.75   97.00   97.00   94.50   97.00   97.00
SO BUILDWID STACK4     94.50   88.75   80.75   69.88   56.88   42.31
SO BUILDLEN STACK4    109.50   97.00   97.25   94.50   88.75   80.50
SO BUILDLEN STACK4     69.88   57.00   42.31   26.44   39.88   54.75
SO BUILDLEN STACK4     67.75   79.00  118.50  121.75  121.50  117.50
SO BUILDLEN STACK4    109.00   97.00   97.25   94.50   88.75   80.50
SO BUILDLEN STACK4     69.88   57.00   42.31   26.44   39.88   54.75
SO BUILDLEN STACK4     67.75   78.75   87.75   93.50   96.75   97.00
SO XBADJ    STACK4    -82.50  -80.00  -75.00  -67.75  -58.25  -47.25
SO XBADJ    STACK4    -34.75  -21.12   -6.84    7.59    6.88    4.38
SO XBADJ    STACK4      2.00   -0.75 -258.50 -268.25 -269.75 -263.00
SO XBADJ    STACK4    -26.50  -17.00  -22.50  -26.75  -30.75  -33.25
SO XBADJ    STACK4    -35.12  -35.88  -35.47  -34.06  -46.75  -59.25
SO XBADJ    STACK4    -69.75  -78.25  -84.25  -87.75  -88.50  -86.50
SO YBADJ    STACK4    -15.91  -26.69  -31.75  -35.75  -38.75  -40.62
SO YBADJ    STACK4    -41.12  -40.12  -38.25  -35.25  -31.50  -26.38
SO YBADJ    STACK4    -20.38  -13.88   43.25    3.19  -32.88  -64.28
SO YBADJ    STACK4     15.81   26.88   31.88   35.75   38.75   40.38
SO YBADJ    STACK4     40.88   40.25   38.00   35.25   31.50   26.25
SO YBADJ    STACK4     20.25   13.62    6.88   -0.19   -7.31  -14.34

SO BUILDHGT STACK5     35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT STACK5     35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT STACK5     35.29   39.60   39.60   39.60   39.60   35.29
SO BUILDHGT STACK5     35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT STACK5     35.29   35.29   35.29   35.29   35.29   35.29
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SO BUILDHGT STACK5     35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDWID STACK5     36.38   39.88   54.75   68.00   79.00   87.75
SO BUILDWID STACK5     93.75   96.75   97.50   94.50   97.00   97.25
SO BUILDWID STACK5     94.25   99.75   94.50   86.12   87.75   42.34
SO BUILDWID STACK5     36.38   40.00   54.75   68.00   79.00   87.75
SO BUILDWID STACK5     93.75   97.00   97.00   94.50   97.00   97.00
SO BUILDWID STACK5     94.50   88.75   80.75   69.88   56.88   42.31
SO BUILDLEN STACK5    109.50   97.00   97.25   94.50   88.75   80.50
SO BUILDLEN STACK5     69.88   57.00   42.31   26.44   39.88   54.75
SO BUILDLEN STACK5     67.75  111.50  118.50  121.75  121.50   97.00
SO BUILDLEN STACK5    109.00   97.00   97.25   94.50   88.75   80.50
SO BUILDLEN STACK5     69.88   57.00   42.31   26.44   39.88   54.75
SO BUILDLEN STACK5     67.75   78.75   87.75   93.50   96.75   97.00
SO XBADJ    STACK5   -107.00 -104.00  -98.00  -89.00  -77.25  -63.25
SO XBADJ    STACK5    -47.12  -29.75  -11.34    7.31   10.75   12.38
SO XBADJ    STACK5     14.00 -225.25 -240.00 -247.25 -247.00   13.50
SO XBADJ    STACK5     -2.00    7.25    0.75   -5.50  -11.75  -17.50
SO XBADJ    STACK5    -22.75  -27.38  -30.97  -33.78  -50.75  -67.38
SO XBADJ    STACK5    -81.75  -93.75 -103.00 -108.75 -111.25 -110.50
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SO YBADJ    STACK5    -62.12  -63.12  -62.25  -59.75  -55.50  -49.38
SO YBADJ    STACK5    -41.62   62.88   27.25   -9.19  -41.50    9.83
SO YBADJ    STACK5     15.56   30.75   40.00   47.75   54.00   58.88
SO YBADJ    STACK5     61.88   63.00   62.00   59.25   55.75   49.25
SO YBADJ    STACK5     41.50   32.62   22.88   12.19    1.19   -9.84

SO BUILDHGT SILO1      35.29   35.29   35.29   35.29   30.71   30.71
SO BUILDHGT SILO1      30.71   30.71   30.71   30.71   30.71   30.71
SO BUILDHGT SILO1      35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT SILO1      35.29   35.29   35.29   35.29   30.71   30.71
SO BUILDHGT SILO1      30.71   30.71   30.71   30.71   30.71   30.71
SO BUILDHGT SILO1      35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDWID SILO1      36.38   39.88   54.75   68.00   19.75   17.25
SO BUILDWID SILO1      14.75   16.00   18.50   20.50   23.00   24.75
SO BUILDWID SILO1     155.00  150.25  140.75  127.50   64.00   42.34
SO BUILDWID SILO1      36.38   40.00   54.75   68.00   19.75   17.25
SO BUILDWID SILO1      14.75   15.75   18.50   20.50   23.00   25.00
SO BUILDWID SILO1     155.00  150.25  140.75  127.38   64.00   42.31
SO BUILDLEN SILO1     109.50   97.00   97.25   94.50   27.75   28.50
SO BUILDLEN SILO1      28.88   28.75   28.22   27.16   25.88   24.00
SO BUILDLEN SILO1     131.75  148.25  160.25  167.25   97.00   97.00
SO BUILDLEN SILO1     109.00   97.00   97.25   94.50   27.75   28.50
SO BUILDLEN SILO1      28.88   28.75   28.22   27.12   25.88   24.12
SO BUILDLEN SILO1     131.50  148.25  160.25  167.50   96.75   97.00
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SO XBADJ    SILO1    -156.50 -178.50 -195.50 -206.25 -149.25 -156.00
SO XBADJ    SILO1    -172.00 -158.50 -155.25 -147.25  -20.75  -21.75
SO XBADJ    SILO1     -22.00  -22.00  -21.50  -20.53  -19.25  -17.62
SO XBADJ    SILO1      25.00   30.25   35.00   38.75   52.25   59.00
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SO YBADJ    SILO1      -0.88    0.50    1.75    3.25    4.25    5.38
SO YBADJ    SILO1      82.00   65.12   46.88   27.00   42.88   28.23
SO YBADJ    SILO1       4.25   -9.88  -28.88  -47.25    3.38    2.12
SO YBADJ    SILO1       0.88   -0.62   -2.25   -3.25   -4.25   -5.50
SO YBADJ    SILO1     -82.00  -65.38  -46.88  -26.94  -42.75  -28.25

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SO BUILDHGT SILO2      35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT SILO2      35.29   35.29   35.29   30.71   30.71   30.71
SO BUILDHGT SILO2      30.71   30.71   30.71   30.71   30.71   35.29
SO BUILDHGT SILO2      35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDWID SILO2      36.38   39.88   54.75   22.00   19.75   17.25
SO BUILDWID SILO2      14.75   16.00   18.50   20.50   23.00  154.75
SO BUILDWID SILO2     155.00  150.25  140.75   69.75   56.88   42.34
SO BUILDWID SILO2      36.38   40.00   54.75   22.25   19.75   17.25
```

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SO BUILDWID SILO2      14.75   15.75   18.50   20.50   23.00  155.00
SO BUILDWID SILO2     155.00  150.25  140.75   69.88   56.88   42.31
SO BUILDLEN SILO2     109.50   97.00   97.25   26.50   27.75   28.50
SO BUILDLEN SILO2      28.88   28.75   28.22   27.16   25.88  111.12
SO BUILDLEN SILO2     131.75  148.25  160.25   93.75   97.00   97.00
SO BUILDLEN SILO2     109.00   97.00   97.25   26.50   27.75   28.50
SO BUILDLEN SILO2      28.88   28.75   28.22   27.12   25.88  111.12
SO BUILDLEN SILO2     131.50  148.25  160.25   93.50   96.75   97.00
SO XBADJ    SILO2      56.50   52.50   47.00  -19.75  -21.00  -21.50
SO XBADJ    SILO2     -21.75  -21.50  -20.94  -19.84  -18.50 -139.75
SO XBADJ    SILO2    -164.50 -184.25 -198.50 -138.50 -147.25 -151.50
SO XBADJ    SILO2    -165.50 -149.25 -144.25   -6.75   -7.00   -7.00
SO XBADJ    SILO2      -7.12   -7.25   -7.28   -7.31   -7.50   28.38
SO XBADJ    SILO2      33.00   36.00   38.25   45.00   50.50   54.50
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SO YBADJ    SILO2      -0.12   -1.50   -2.75   -3.75   -5.00   84.88
SO YBADJ    SILO2      69.25   51.38   32.38   48.25   31.56   14.02
SO YBADJ    SILO2      -8.97  -21.75  -38.88   -3.62   -2.12   -1.12
SO YBADJ    SILO2       0.12    1.38    2.25    3.75    5.00  -84.75
SO YBADJ    SILO2     -69.25  -51.62  -32.38  -48.19  -31.56  -14.03

SO BUILDHGT SILO3      35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT SILO3      35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT SILO3      35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT SILO3      35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT SILO3      35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT SILO3      35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDWID SILO3      36.38   39.88   54.75   68.00   79.00   87.75
SO BUILDWID SILO3      93.75   96.75  166.50  158.50  156.25  154.75
SO BUILDWID SILO3     155.00  150.25  140.75  127.50   64.00   43.31
SO BUILDWID SILO3      36.38   40.00   54.75   68.00   79.00   87.75
SO BUILDWID SILO3      93.75   97.00  166.50  158.00  156.50  155.00
SO BUILDWID SILO3     155.00  150.25  140.75  127.38   64.00   43.31
SO BUILDLEN SILO3     109.50   97.00   97.25   94.50   88.75   80.50
SO BUILDLEN SILO3      69.88   57.00   89.22   65.75   87.25  111.12
SO BUILDLEN SILO3     131.75  148.25  160.25  167.25   97.00   97.00
SO BUILDLEN SILO3     109.00   97.00   97.25   94.50   88.75   80.50
SO BUILDLEN SILO3      69.88   57.00   89.22   65.72   87.25  111.12
SO BUILDLEN SILO3     131.50  148.25  160.25  167.50   96.75   97.00
SO XBADJ    SILO3      31.50   33.00   33.75   33.50   32.50   30.00
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SO XBADJ    SILO3    -140.00 -130.00 -131.25 -128.00 -121.25 -110.75
SO XBADJ    SILO3     -96.88  -80.00  -41.28  -14.91  -11.00   -8.75
SO XBADJ    SILO3      -6.00   -3.50   -0.50    2.50   16.50   24.50
SO YBADJ    SILO3     -21.50  -12.44    1.88   16.25   30.00   42.88
SO YBADJ    SILO3      54.62   64.62   91.25   89.75   80.88   71.62
SO YBADJ    SILO3      62.75   51.88   39.38   25.88   48.00   39.09
SO YBADJ    SILO3      21.41   12.62   -1.75  -16.25  -30.25  -43.12
SO YBADJ    SILO3     -54.62  -64.75  -91.25  -89.50  -80.75  -71.75
SO YBADJ    SILO3     -62.75  -51.88  -39.38  -25.81  -48.00  -39.09
```

APPENDIX D
SITE-SPECIFIC AERMET SEASONAL VALUES

MIRANT POTOMAC RIVER, LLC

Seasonal Surface Roughness used for Input to AERMET (Years 2000-2004)

Fractional Land-Use (deg)	Spring	Summer	Autumn	Winter
Seasonal Weighted Average Surface Roughness				
60-120	0.56	0.60	0.53	0.50
120-180	0.15	0.17	0.14	0.13
180-360	0.81	0.88	0.76	0.70
360-60	0.26	0.30	0.23	0.20

Month	Season	Monthly Weighted Surface Roughness			
		60-120	120-180	180-360	360-60
January	Autumn	0.53	0.14	0.76	0.23
February	Autumn	0.53	0.14	0.76	0.23
March	Autumn	0.53	0.14	0.76	0.23
April	Spring	0.56	0.15	0.81	0.26
May	Summer	0.60	0.17	0.88	0.30
June	Summer	0.60	0.17	0.88	0.30
July	Summer	0.60	0.17	0.88	0.30
August	Summer	0.60	0.17	0.88	0.30
September	Summer	0.60	0.17	0.88	0.30
October	Summer	0.60	0.17	0.88	0.30
November	Autumn	0.53	0.14	0.76	0.23
December	Autumn	0.53	0.14	0.76	0.23

Seasonal Albedo used for Input to AERMET (Years 2000-2004)

Fractional Land-Use (deg)	Spring	Summer	Autumn	Winter
Seasonal Weighted Average Albedo				
60-120	0.14	0.15	0.17	0.38
120-180	0.13	0.11	0.15	0.25
180-360	0.14	0.15	0.17	0.41
360-60	0.13	0.12	0.15	0.31

Month	Season	Monthly Weighted Albedo			
		60-120	120-180	180-360	360-60
January	Autumn	0.17	0.15	0.17	0.15
February	Autumn	0.17	0.15	0.17	0.15
March	Autumn	0.17	0.15	0.17	0.15
April	Spring	0.14	0.13	0.14	0.13
May	Summer	0.15	0.11	0.15	0.12
June	Summer	0.15	0.11	0.15	0.12
July	Summer	0.15	0.11	0.15	0.12
August	Summer	0.15	0.11	0.15	0.12
September	Summer	0.15	0.11	0.15	0.12
October	Summer	0.15	0.11	0.15	0.12
November	Autumn	0.17	0.15	0.17	0.15
December	Autumn	0.17	0.15	0.17	0.15

Seasonal Bowen Ratio used for Input to AERMET (Years 2000-2004)

Fractional Land-Use (deg)	Average				Dry				Wet			
	Spring	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter
	Seasonal Weighted Geometric Mean Bowen Ratio											
60-120	0.45	0.65	0.77	1.50	0.80	1.15	1.29	2.00	0.29	0.40	0.45	0.44
120-180	0.15	0.16	0.17	1.50	0.17	0.18	0.20	2.00	0.13	0.14	0.15	0.33
180-360	0.72	1.03	1.35	1.50	1.46	2.05	2.61	2.00	0.39	0.56	0.67	0.49
360-60	0.21	0.24	0.28	1.50	0.29	0.33	0.37	2.00	0.17	0.19	0.21	0.37

Month	Season	Average / Wet / Dry Year 2000	Year	Monthly Weighted Bowen Ratio			
				60-120	120-180	180-360	360-60
January	Autumn	Average	2000	0.77	0.17	1.35	0.28
February	Autumn	Average	2000	0.77	0.17	1.35	0.28
March	Autumn	Average	2000	0.77	0.17	1.35	0.28
April	Spring	Average	2000	0.45	0.15	0.72	0.21
May	Summer	Average	2000	0.65	0.16	1.03	0.24
June	Summer	Average	2000	0.65	0.16	1.03	0.24
July	Summer	Average	2000	0.65	0.16	1.03	0.24
August	Summer	Average	2000	0.65	0.16	1.03	0.24
September	Summer	Average	2000	0.65	0.16	1.03	0.24
October	Summer	Dry	2000	1.15	0.18	2.05	0.33
November	Autumn	Average	2000	0.77	0.17	1.35	0.28
December	Autumn	Average	2000	0.77	0.17	1.35	0.28

Month	Season	Average / Wet / Dry				
		2000	2001	2002	2003	2004
January	Autumn	Average	Average	Dry	Average	Dry
February	Autumn	Average	Average	Dry	Wet	Average
March	Autumn	Average	Average	Average	Average	Average
April	Spring	Average	Average	Average	Average	Average
May	Summer	Average	Average	Average	Average	Average
June	Summer	Average	Average	Average	Wet	Average
July	Summer	Average	Average	Average	Average	Average
August	Summer	Average	Average	Dry	Average	Average
September	Summer	Average	Dry	Average	Average	Average
October	Summer	Dry	Dry	Average	Average	Average
November	Autumn	Average	Dry	Average	Average	Average
December	Autumn	Average	Average	Average	Average	Average

Attachment 2

Protocol for Modeling the Effects of Downwash from Mirant's Potomac River Power Plant

Mirant Potomac River, LLC
Alexandria, Virginia

Protocol for Modeling the Effects of Downwash from Mirant's Potomac River Power Plant

ENSR Corporation
March 2005
Document Number 10350-002-400

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1.0 INTRODUCTION

1.1 Project Overview

Mirant Potomac River, LLC (Mirant) submitted a modeling protocol on October 13, 2004 pursuant to an Order By Consent issued by the Commonwealth of Virginia, State Air Pollution Control Board. The Protocol described MIrant's proposed refined modeling analysis to assess the effect of aerodynamic downwash from the facility on ambient concentrations of sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO) and particulate matter with an aerodynamic diameter less than or equal to 10 micrometers (PM_{10}). The Protocol described the methods to be used to assess compliance with the National Ambient Air Quality Standards for these pollutants. In addition, the Protocol described the methods to be used to assess the effect of downwash from the facility on ambient concentrations of mercury for comparison to the applicable Standards of Performance for Toxic Pollutants set forth in VAC 5-60-200, et. Seq., in the area immediately surrounding the facility. The Order is included in Appendix A of this protocol.

Mirant received written comments, dated February 10, 2005, from Mr. Ken McBee, Modeling Coordinator for the Virginia Department of Environmental Quality, Office of Air Permit Programs. The letter required Mirant to submit a revised protocol within 30 days (March 15, 2005). On March 8, 2005 Mr. McBee granted Mirant a 10-day extension to March 25, 2005 in order to incorporate recently received GIS data from the City of Alexandria. The GIS data contains building height data for high rise apartments for use as flagpole receptors in the modeling. This revised protocol is being submitted in response to Mr. McBee's written comments.

1.2 Protocol Outline

This document is a modeling protocol for the use of EPA's proposed Guideline model, AERMOD with PRIME (hereafter called AERMOD), to assess downwash from Mirant's Potomac River Generating Station. AERMOD is technically superior to the downwash algorithm in EPA's current Guideline model, ISCST3.

Section 2 of this protocol describes the facility and lists the permitted or maximum emission rates. Section 3 discusses the proposed approach for conducting the air quality dispersion modeling analysis including the dispersion model selection criteria, the Good Engineering Practice (GEP) stack height and downwash modeling inputs, model receptor locations and proposed meteorological database. Section 4 describes representative ambient background data. Section 5 describes how results will be documented. References are listed in Section 6.

1.3 Basis For Ambient Compliance

Modeled concentrations of criteria pollutants will be added to a monitored background concentration and the total will be compared to the NAAQS shown in Table 1-1. The monitored background concentration represents the contribution to total air quality from all other sources in the area. Modeled concentrations of mercury will be compared to the mercury limits contained in the Standards of Performance for Toxic Pollutants.

Table 1-1 National Ambient Air Quality Standards and Standards of Performance for Toxic Pollutants

Pollutant	Averaging Period	Primary NAAQS ($\mu g/m^3$)	Secondary NAAQS ($\mu g/m^3$)
NO_2	Annual(1)	100	100
SO_2	Annual(1)	80	None
	24-hour(2)	365	None
	3-hour(2)	None	1,300
PM_{10}	Annual(4)	50	50
	24-hour(3,5)	150	150
CO	8-hour(2)	10,305	10,305
	1-hour(2)	40,075	40,075

(1) Not to be exceeded
(2) Not to be exceeded more than once per year
(3) Not to be exceeded more than an average of one day per year over three years
(4) Not to be exceeded by the arithmetic average of the annual arithmetic averages from 3 successive years
(5) Compliance with the 24-hour standard is demonstrated when the 6th highest 24-hour concentration at each receptor, based on 5 years of modeling, is predicted below the standard Source 40 CFR 50

The NAAQS have been developed for various durations of exposure. The short-term (24-hours or less) NAAQS for SO_2 and CO refer to exposure levels not to be exceeded more than once per year. Long-term NAAQS for SO_2 and NO_2 refer to limits that cannot be exceeded for annual exposure. Compliance with the PM_{10} 24-hour and annual standards are statistical, not deterministic. The standards are attained when the expected number of exceedances each year is less than or equal to one. When modeling with a five-year meteorological data set, compliance with the 24-hour standard is demonstrated when the 6th highest 24-hour concentrations at each receptor, based on the 5 year data set, is predicted to be below the standard. Compliance with the annual standard is demonstrated when the arithmetic average of the annual arithmetic average from 3 successive years is predicted to be below the standard at each receptor.

The limits for mercury in the Standards of Performance for Toxic Pollutants are not to be exceeded and have been established for the annual and 1-hour averaging periods for mercury vapor. The TLV-TWA 8-hour limit for mercury vapor is equal to 0.025 mg/m^3 (25 $\mu g/m^3$). The Virginia Air Code 9VAC5-60-230 states that the annual ambient concentration (from the facility) should not exceed 1/500 of the TLV-TWA (or 0.05 $\mu g/m^3$) and the 1-hour concentration from the facility should not exceed 1/20 of the TLV-TWA (1.25 $\mu g/m^3$)

1.4 Modeling Limitations

The purpose of this analysis is to assess compliance with ambient standards. The analysis will incorporate several conservative assumptions to ensure that the absolute maximum pollutant concentrations will be predicted. For example, the modeling will use the highest permitted emissions or highest measured emissions for pollutants having no permit limits. The modeling will assume that all combustion sources at the power plant are operating at maximum load for the entire year. The model itself was developed and verified to overpredict actual maximum expected pollutant concentrations. Thus, highest model predicted pollutant concentrations presented in the final report will be higher than actual maximum concentrations.

2.0 PROJECT DESCRIPTION

The Potomac River Generating Station consists of five bituminous coal-fired electric utility steam generating units. Units #1 and #2 each generate 88 megawatts of electricity. Units #3, #4 and #5 each generate 102 megawatts. The facility is located in Alexandria, VA, approximately 1 mile south of Reagan National Airport. Figure 2-1 depicts the site location.

There are five boiler stacks at the power plant. Flue gases from each boiler exit into the atmosphere through its own stack. Each boiler unit is equipped with hot and cold side electrostatic precipitators for particulate control.

Table 2-1 presents stack parameters and permitted emissions rates for SO_2, NOx and TSP/PM_{10} that will be used in the dispersion modeling. The facility does not have limits on CO and mercury emissions. Maximum CO emissions were determined from the facility's continuous emission monitoring (CEMs) system. The maximum 1- and 8-hour CO emission rates for modeling are based on 10% above maximum measured values during calendar year 2004. The maximum short-term and annual average mercury emission rate is calculated using an emission factor of 2.53E-06 lb/MMBtu. This is the emission factor reported by Mirant Potomac in their annual Toxic Release Inventory (TRI) reporting. Maximum short term mercury emissions from each unit were calculated by multiplying this emission factor by the maximum capacity in MMBtu/hr of each unit. The result is a lb/hr emission rate for modeling. The annual mercury emissions will be calculated by multiplying the 2.53E-06 lb/MMBtu emission factor by the most recent two year average of the power plant's total annual heat input in MMBtu/yr. The result is a lb/yr emission rate. This emission rate will be divided by 8,760 hours in a year to arrive at a lb/hr emission rate for modeling. Annualized lb/hr mercury emissions will be apportioned equally to each unit.

Coal is transported to the site by rail. Coal is unloaded to an underground conveyor system, transported to the breaker house, and from there to the boiler building. Coal that is not fed directly to the boiler building is distributed onto a coal pile in the coal storage yard. Coal reclaimed from the yard is dumped onto the same underground conveyor system and routed to the boiler building. Bottom ash from the boilers and fly ash from the precipitators are stored in silos located on the south side of the boiler house. The ash is then loaded into covered trucks and removed from the facility. Tables 2-1 and 2-2 present point source release parameters from the ash silos and release geometry from the fugitive sources on site. Figure 2-2 shows the locations of point and fugutive sources.

Figure 2-1 Mirant Potomac River Generating Station Location

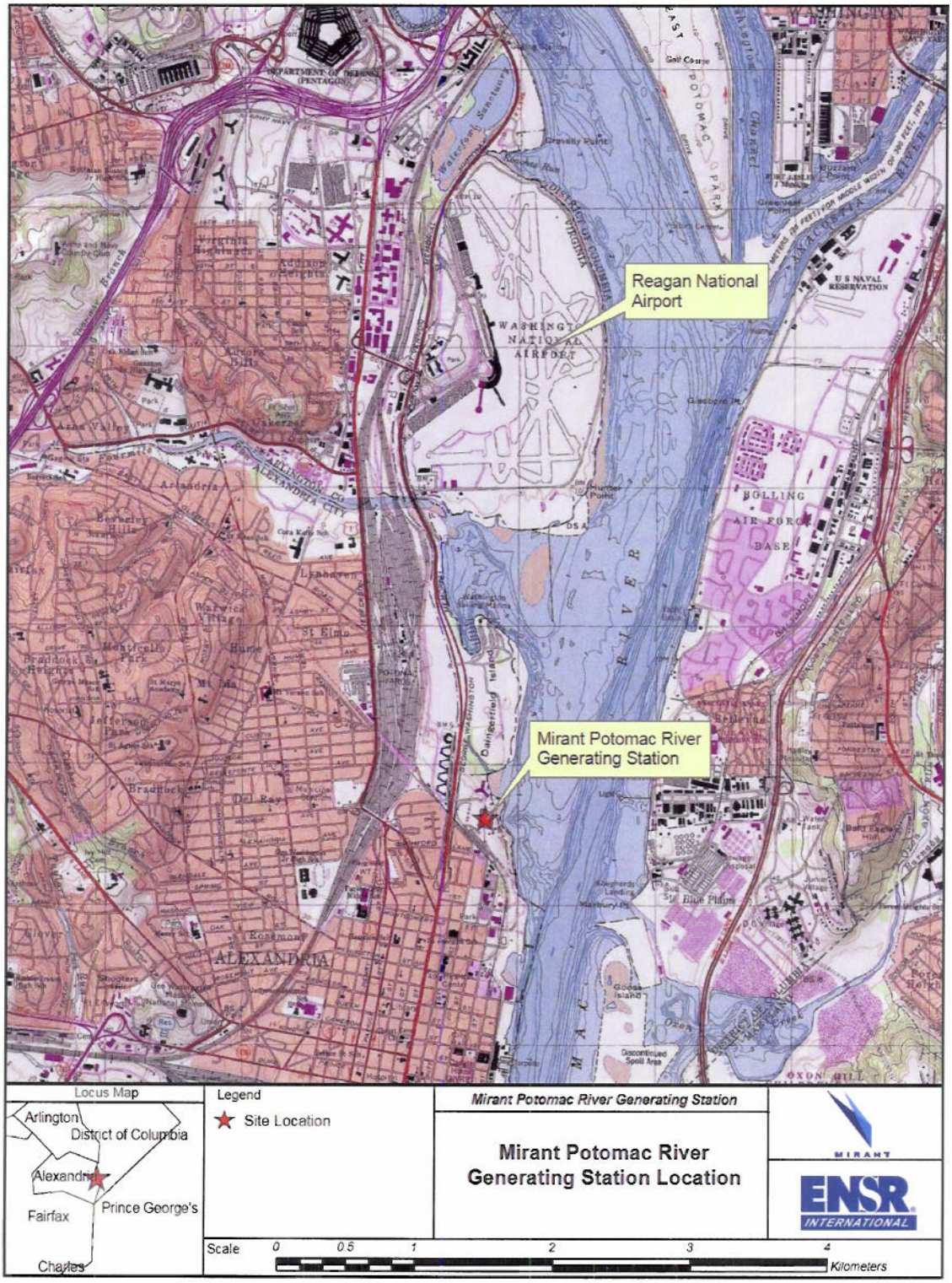


Table 2-1 Point Sources Stacks Parameters and Emissions

Point Source	Heat Input	SO_2		NOx		TSP/PM_{10}		CO			Hg	
	MMBtu/hr	lb/hr[1]	g/sec	lb/hr[2]	g/sec	lb/hr[3]	g/sec	ppmv[4]	lb/hr	g/sec	lb/hr[5]	g/sec
Boiler 1/ Stack 1	970.1	1474.6	185.8	436.5	55.0	116.4	14.7	680.9	860.7	108.4	2.45E-03	3.092E-04
Boiler 2/ Stack 2	970.1	1474.6	185.8	436.5	55.0	116.4	14.7	688.6	870.4	109.7	2.45E-03	3.092E-04
Boiler 3/ Stack 3	960.7	1460.3	184.0	432.3	54.5	115.3	14.5	631.2	790.1	99.6	2.43E-03	3.062E-04
Boiler 4/ Stack 4	960.7	1460.3	184.0	432.3	54.5	115.3	14.5	677.5	848.1	106.9	2.43E-03	3.062E-04
Boiler 5/ Stack 5	960.7	1460.3	184.0	432.3	54.5	115.3	14.5	645.9	808.6	101.9	2.43E-03	3.062E-04
Fly Ash Silo	-	-	--	-	--	3.3	0.4	-	-	-	-	-
Fly Ash Silo	-	-	--	-	--	3.3	0.4	-	-	-	-	-
Bottom Ash Silo	-	-	--	-	--	0.7	0.1	-	-	-	-	-

Notes:

Stack diameter = diameter of venturi nozzle in stack.

Modeled stack height = height of top of venturi nozzle (48.2 meters). Actual stack height = 49.1 m.
Original stack design (1947) included these venturi nozzles to increase exit velocity due to FAA height restrictions.

[1] SO_2 emissions calculations: SO_2 (lb/hr) = 1.52K, where K = total heat input (MMBtu/hr) (9 VAC 5-40-930).

[2] NOx emissions calculations: 0.45 lb/MMBtu (annual average) based on Nox RACT limits.

[3] TSP/PM_{10} emissions calculations: 0.12 lb/MMBtu based on 9 VAC 5-40-900. All TSP assumed to be PM_{10}.

[4] CO emissions based on 10% above highest 1-hour CEM measurement during period 1/1/04 - 12/31/04

CO conversion from ppmv to lb/MMBtu: 1 ppmv =0.001303 lb/MMBtu (assumes flue gas dry @ 3% oxygen).

[5] Mercury emissions based on 2.53 lb/trillion Btu from TRI reporting.

Table 2-1 Point Sources Stacks Parameters and Emissions (cont.)

Point Source	Height m	Diameter m	Temp Deg K	Velocity m/sec	Base Elevation m	UTM-X[6] m	UTM-Y[6] m
Boiler 1/Stack 1	48.2	2.6	444.3	35.7	10.4	322803.6	4298573.9
Boiler 2/Stack 2	48.2	2.6	455.4	30.2	10.4	322807.3	4298597.6
Boiler 3/Stack 3	48.2	2.4	405.4	30.8	10.4	322811.1	4298621.0
Boiler 4/Stack 4	48.2	2.4	405.4	33.2	10.4	322814.7	4298644.3
Boiler 5/Stack 5	48.2	2.4	405.4	33.8	10.4	322819.0	4298668.0
Fly Ash Silo	33.6	1.0	293.0	0.1	10.4	322796.5	4298489.3
Fly Ash Silo	33.6	1.0	293.0	0.1	10.4	322810.7	4298494.2
Bottom Ash Silo	31.0	1.0	293.0	0.1	10.4	322785.1	4298523.9

[6] Datum: NAD27, UTM Zone 18

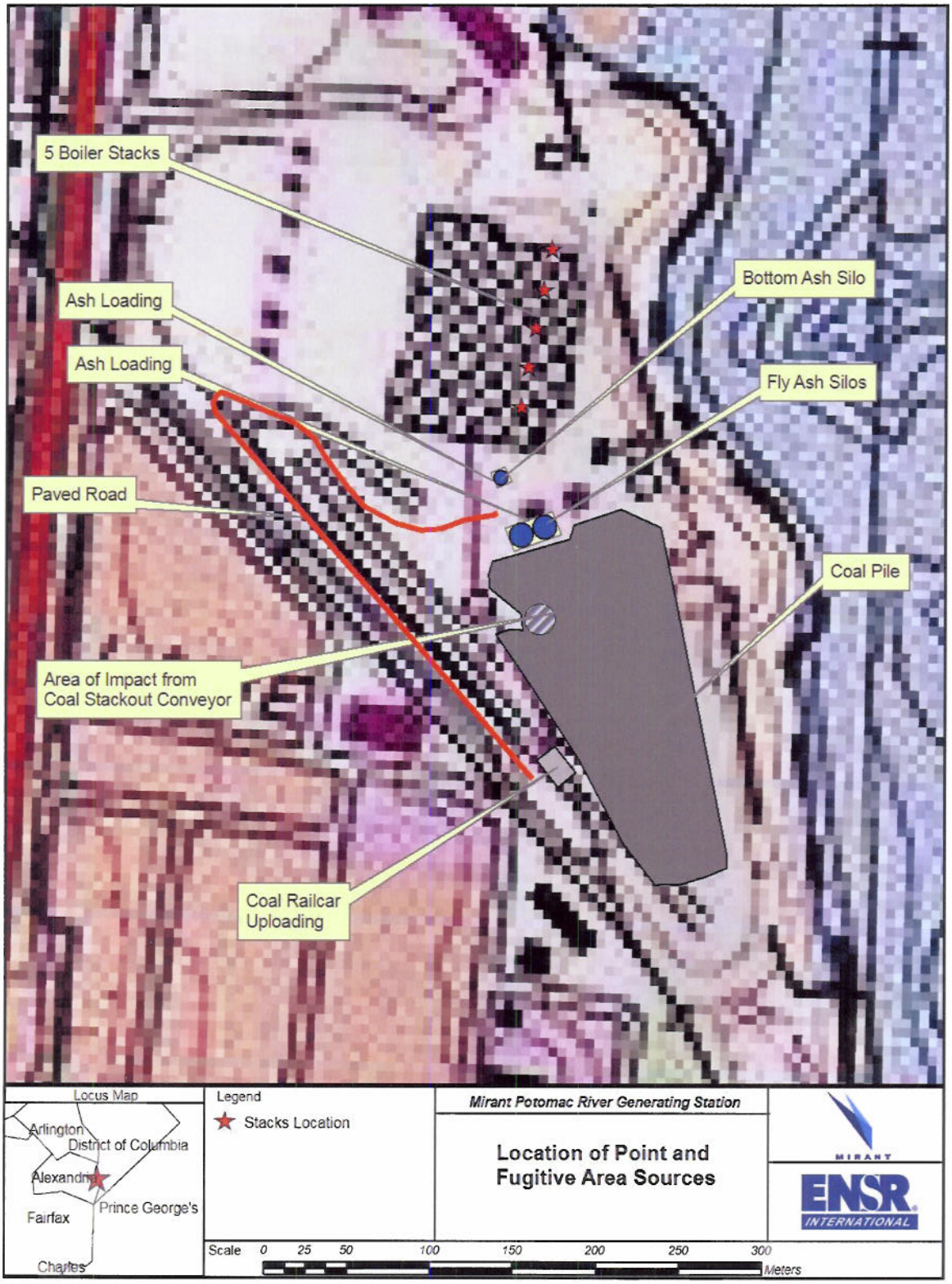
Table 2-2 Area Sources Parameters and Emissions

Area Sources	Size m^2	Height m	PM_{10} Existing Emissions			
			lb/hr	tpy	g/sec	g/sec-m^2
Ash Loader Upgrade	546	2.0	0.102	0.07	0.013	2.36E-05
Ash Loading System Dust Suppression						
Coal Pile Wind Erosion and Dust Suppression	17,679	4.6	3.260	1.98	0.411	2.32E-05
Coal Stackout Conveyor Dust Suppression	263	9.1	0.046	0.20	0.006	2.19E-05
Coal Railcar Unloading Dust Suppression	288	1.0	0.123	0.06	0.016	5.39E-05
Ash trucks on Paved Roads	5,886	1.0	0.124	0.24	0.016	2.66E-06

Notes:

Coal Pile = 4 acres = 17,679 m^2.
Modeled height of coal pile = one half of average pile height = 30 feet x 0.5 = 15 feet (4.6 m).
Modeled height of stackout conveyor dust suppression = average height of coal pile (9.1 m).
Resuspended roadway dust from paved roads: area = 2 x 0.3 miles x 20 feet wide = 5,886 m^2.

Figure 2-2 Point and Fugitive Sources



3.0 DISPERSION MODELING ANALYSIS

3.1 Model Selection

In 1991, the USEPA, in conjunction with the American Meteorological Society (AMS), formed the AMS/USEPA Regulatory Model Improvement Committee (AERMIC). AERMIC's charter was to build upon earlier modeling developments to provide a state-of-the-art dispersion model. The resulting model was AERMOD with PRIME algorithm (hereafter called AERMOD). The PRIME downwash algorithm is technically superior to the downwash algorithm in ISCST3 because the former was developed based on extensive wind tunnel testing that was not available to the developers of ISCST3. The PRIME algorithm allows the model to calculate impacts in the cavity region immediately downwind of a downwashing stack.

Based upon the scientific formulation of AERMOD and its evaluation performance, USEPA is proposing that AERMOD replaces ISCST3 and CTDMPLUS as refined dispersion modeling techniques for simple and complex terrain for receptors within 50 km of a modeled source. Since AERMOD does not have limitations in modeling either simple or complex terrain, USEPA is proposing it as a refined technique for all terrain types.

For this project, given that USEPA has proposed AERMOD as a guideline model to replace ISCST3 and CTDMPLUS, MIRANT proposes to use AERMOD (Version 02222). This model and version is expected to be promulgated as a Guideline model in the near future.

AERMOD represents an advance in the formulation of a steady-state, Gaussian plume model. It is apparent that AERMOD has an advantage over the guideline model ISCST3 when the various scientific components are compared (Paine et al., 1998). Therefore, AERMOD would be expected to perform at least as well as or better than the existing modeling techniques, such as ISCST3. The VADEQ has requested approval from EPA Region 3 to use AERMOD for this study.

3.2 Good Engineering Practice Stack Height Analysis

A Good Engineering Practice (GEP) stack height analysis was performed based on the current facility design to determine the potential for building-induced aerodynamic downwash for all five boiler stacks. The analysis procedures described in EPA's Guidelines for Determination of Good Engineering Practice Stack Height (EPA, 1985), Stack Height Regulations (40 CFR 51), and current Model Clearinghouse guidance were used. A GEP stack height is defined as the greater of 65 meters (213 feet), measured from the ground elevation of the stack, or the formula height (H_g), as determined from the following equation:

$H_g = H + 1.5\ L$

where

H is the height of the nearby structure which maximizes H_g, and

L is the lesser dimension (height or projected width) of the building.

The GEP analysis was conducted using Lakes Environmental's BPIP View (v 4.8.5) software. The controlling structure for determining the GEP formula height for boiler stacks 2 – 5 is Marina Towers. Boiler stack 1, the southernmost stack, is just outside of the influence of Marina Towers. The controlling structure for boiler stack 1 is the boiler building. Figure 3-1 shows the structures that could affect stack downwash. Figure 3-2 shows these structures in three dimensions. Table 3-1 presents the dimensions of these structures from the BPIP output. The GEP height for the boiler stack 1 is 88.2 meters and 97.1 meters for the boiler stacks 2-5. Since the GEP height exceeds the 48.2 meter stack heights, BPIP generated wind direction-specific structure dimensions will be input to AERMOD to simulate downwash from each stack. These dimensions are included in Appendix B.

Table 3-1 Summary of GEP Analysis (Units in Meters)

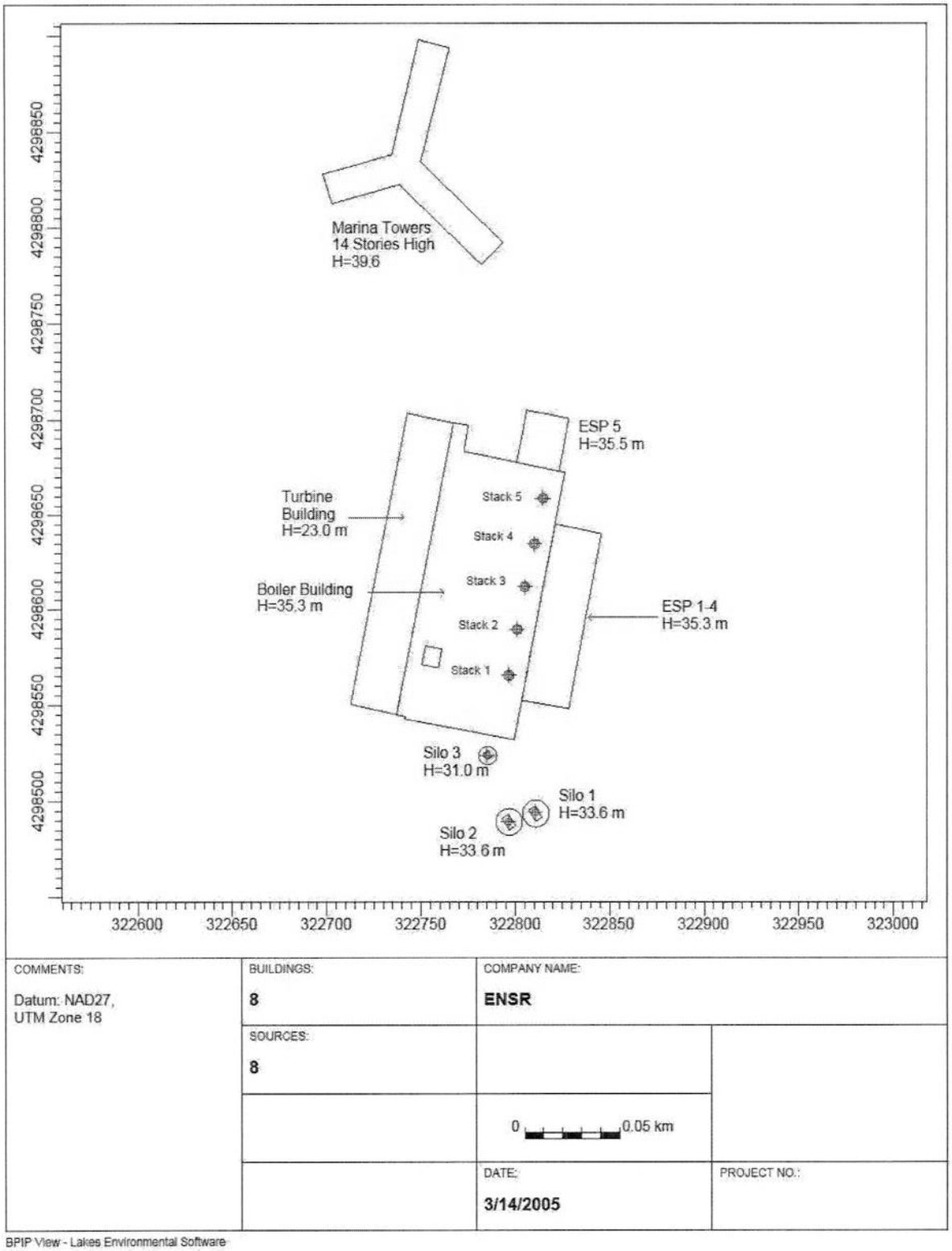
Structure	Height	Length	Width	MPW[(1)]	GEP Formula Height	5L[(2)]	Base Elevation
Boiler Building	35.3	158.0	64.0	170.5	88.2	176.5	10.4
Turbine Building	23.0	156.0	26.0	158.2	57.5	115.0	10.4
ESP 1-4	35.3	94.5	25.0	97.8	88.2	176.5	10.4
ESP 5	35.3	26.0	24.0	35.4	88.2	176.5	10.4
Silo 1	33.6	N/A	13.7	13.7	54.2	68.5	10.4
Silo 2	33.6	N/A	13.7	13.7	54.2	68.5	10.4
Silo 3	31.0	N/A	9.4	9.4	45.1	47.0	10.4
Marina Towers	39.6	N/A	16.3	90.4	97.1	198.0	8.5

(1) Maximum projected width.
(2) 5 times the lesser of the MPW or height is the maximum influence region.

Table 3-2 Summary of GEP Analysis (Units in Meters) (cont.)

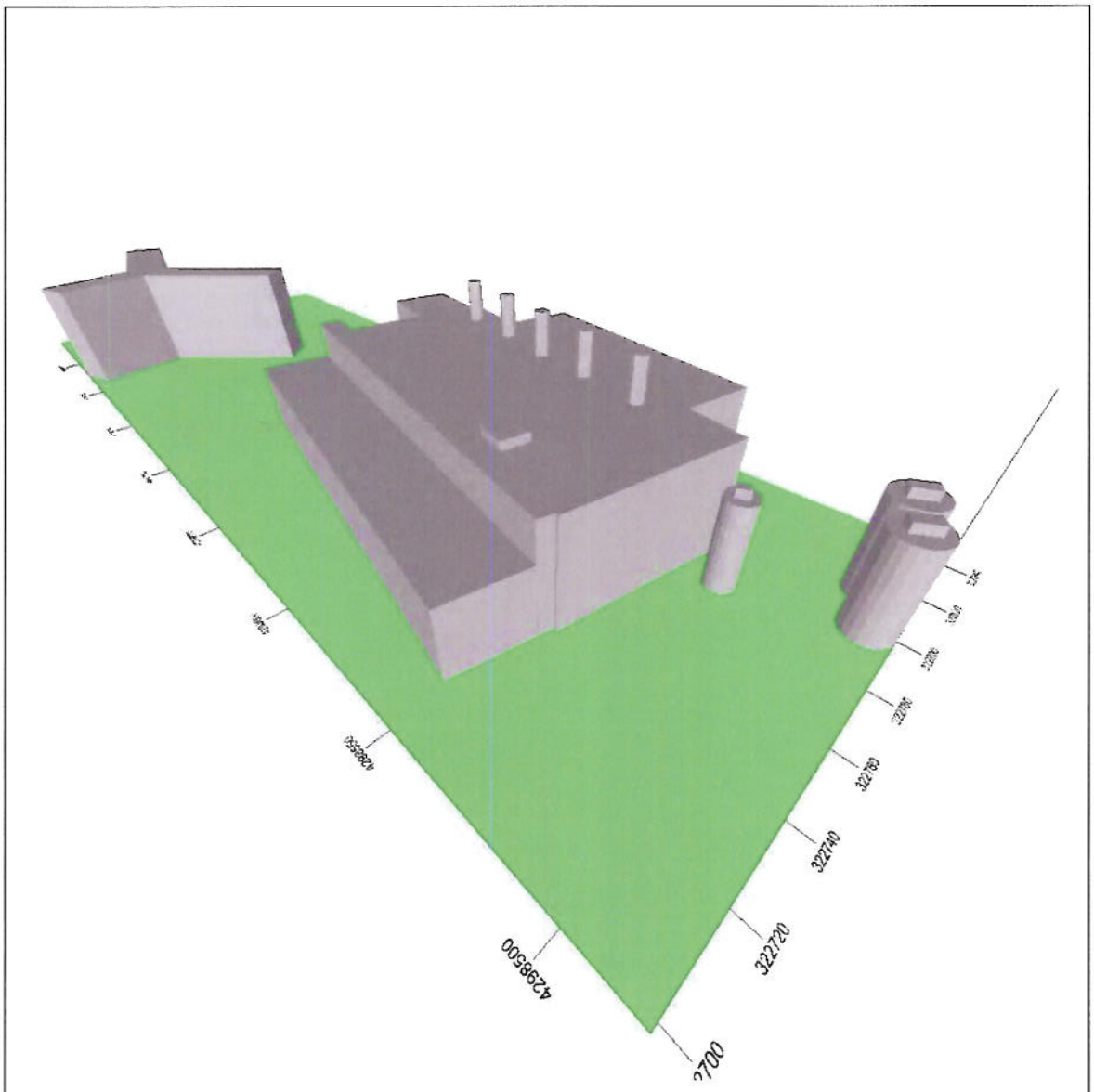
Structure	Distance to the Main Boilers					Stacks Potentially Affected By Downwash				
	1	2	3	4	5	1	2	3	4	5
Boiler Building	0.0	0.0	0.0	0.0	0.0	yes	yes	yes	yes	yes
Turbine Building	55.0	55.0	55.0	55.0	55.0	yes	yes	yes	yes	yes
ESP 1-4	9.6	9.6	9.6	9.6	15.0	yes	yes	yes	yes	yes
ESP 5	111.0	87.3	63.0	40.0	15.7	yes	yes	yes	yes	yes
Silo 1	72.0	96.0	119.0	143.0	167.0	no	no	no	no	no
Silo 2	69.0	92.0	114.0	158.0	161.5	no	no	no	no	no
Silo 3	37.8	62.0	86.0	110.0	134.0	yes	no	no	no	no
Marina Towers	215.0	192.0	170.0	148.0	127.0	no	yes	yes	yes	yes

Figure 3-1 Mirant Potomac River Generating Station Configuration Used for GEP Analysis



BPIP View - Lakes Environmental Software

Figure 3-2 Mirant Potomac River Generating Station Configuration Used for GEP Analysis in 3D



COMMENTS: 3-D View of the Mirant GEP Structures	COMPANY NAME:	
	MODELER:	
	DATE: **3/14/2005**	PROJECT NO.:

3D View - Lakes Environmental Software

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3.3 Building Cavity Analysis

The PRIME downwash algorithm within AERMOD calculates pollutant concentrations within the cavity region. Therefore, no additional analysis (e.g., SCREEN3) is necessary.

3.4 Terrain and Receptor Data

The downwash analysis will be conducted out to 5 km. Beyond a distance of approximately 1-2 km effects of downwash cannot be distinguished from ambient impacts of the released effluent that are caused by atmospheric turbulence alone. The receptor grid extends out to 5 km at the request of VADEQ. The receptor grid to be used in AERMOD will be chosen from the USGS maps in accordance with standard EPA procedures. Fenceline receptors will be established at 50 m spacing along the property boundary, surrounded by discrete Cartesian receptors placed out to:

0 - 1 km with 100 m spacing.
1 - 3 km with 250 m spacing
3 - 5 km with 500 m spacing

Figures 3-3 and Figure 3-4 show the receptor grid.

Multi-story residential buildings located within approximately 1-2 km from the facility will be modeled with flagpole receptors. Table 3-3 presents these buildings.

AERMOD requires each receptor to identify a "height scale" which is defined as the height of a nearby controlling hill. The controlling hill heights and receptor elevations will be generated from USGS digital elevation model (DEM) files. Receptor coordinates and elevations are listed in Appendix C.

Table 3-3 Multi-Story Buildings Parameters (Used for Flagpole Receptors)

Multi-Story Building	UTM-X (m) [1]	UTM-Y (m) [1]	# of Stories [2]	Building Height (m) [3]	Story Height (m) [5]
Alexandria House	322630.38	4297725.55	22	64.9	3.0
Carlyle Towers	320703.66	4296828.68	20	46.0	2.3
Carydale East	319579.69	4297276.05	18	48.3	2.7
Port Royal Condo	322652.21	4297815.58	17	46.1	2.7
Braddok Place [5]	321792.71	4298023.30	10	29.9	3.0
The Calvert Apartment	321128.13	4300123.85	15	42.7	2.8
Portals of Alexandria	320730.05	4301226.85	14	44.8	3.2
Marina Towers	322741.09	4298831.15	14	39.6	2.8

[1] Datum: NAD27, UTM Zone 18
[2] The data was obtained from Attachment III of 12/30/04 letter to Ken McBee from City of Alexandria, Department of Transportation and Environmental Services.
[3] Building heights were obtained from the City of Alexandria Department of Planning and Zoning GIS Data.
[4] Flagpole receptors will be placed at every story, 3.0 meters apart. Flagpole receptors at the Marina Towers will be placed on each balcony facing the Mirant facility, 2.83 meters apart.
[5] Attachment III lists Meridian Building as 16 stories. The height of this building was not available from the GIS data, therefore we placed flagpole receptors at the neighboring Braddock Place building. Based on the height of the Braddock Place building we assumed that it consists of ten stories.

Figure 3-3 AERMOD Receptor Grid

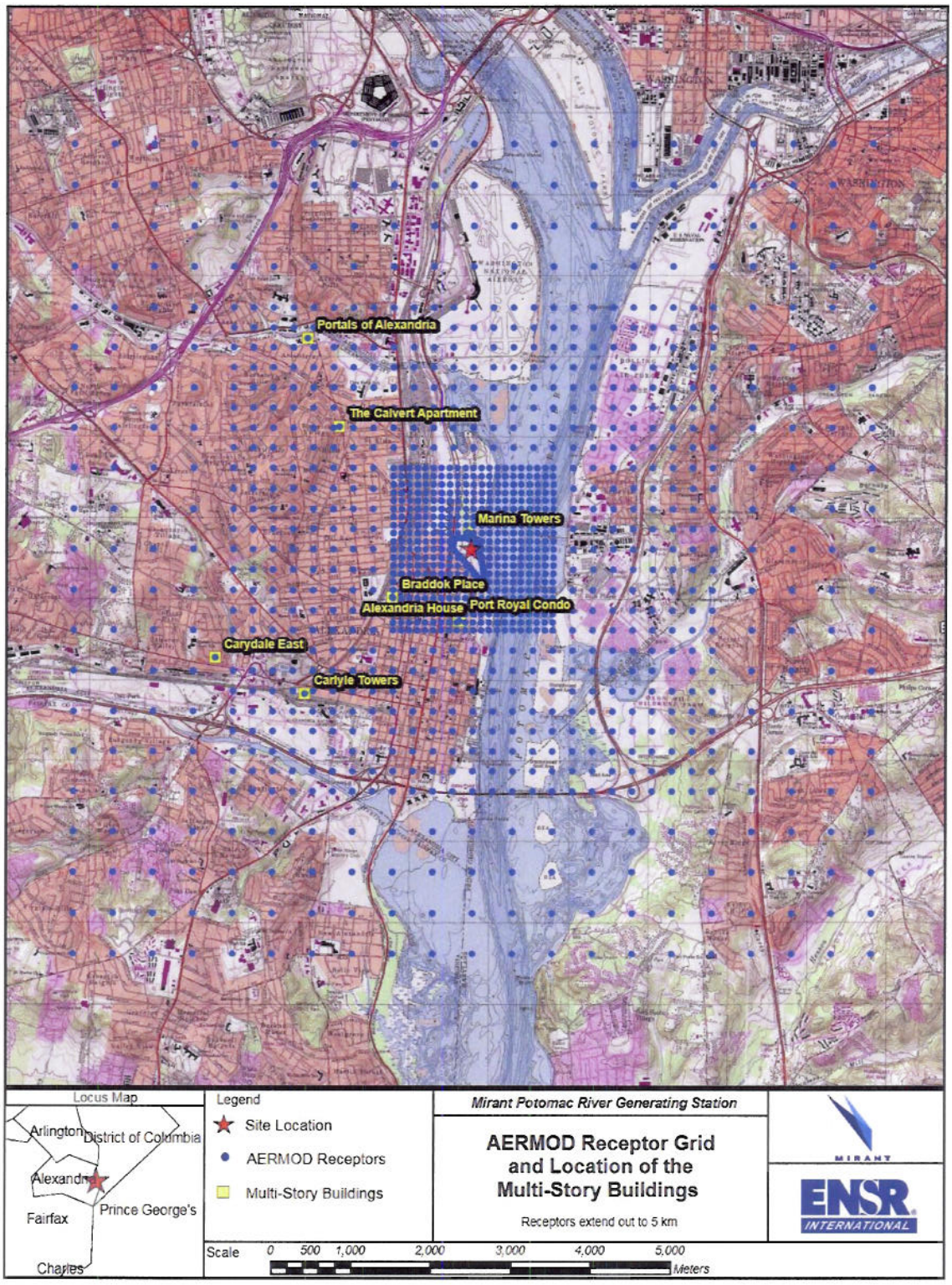
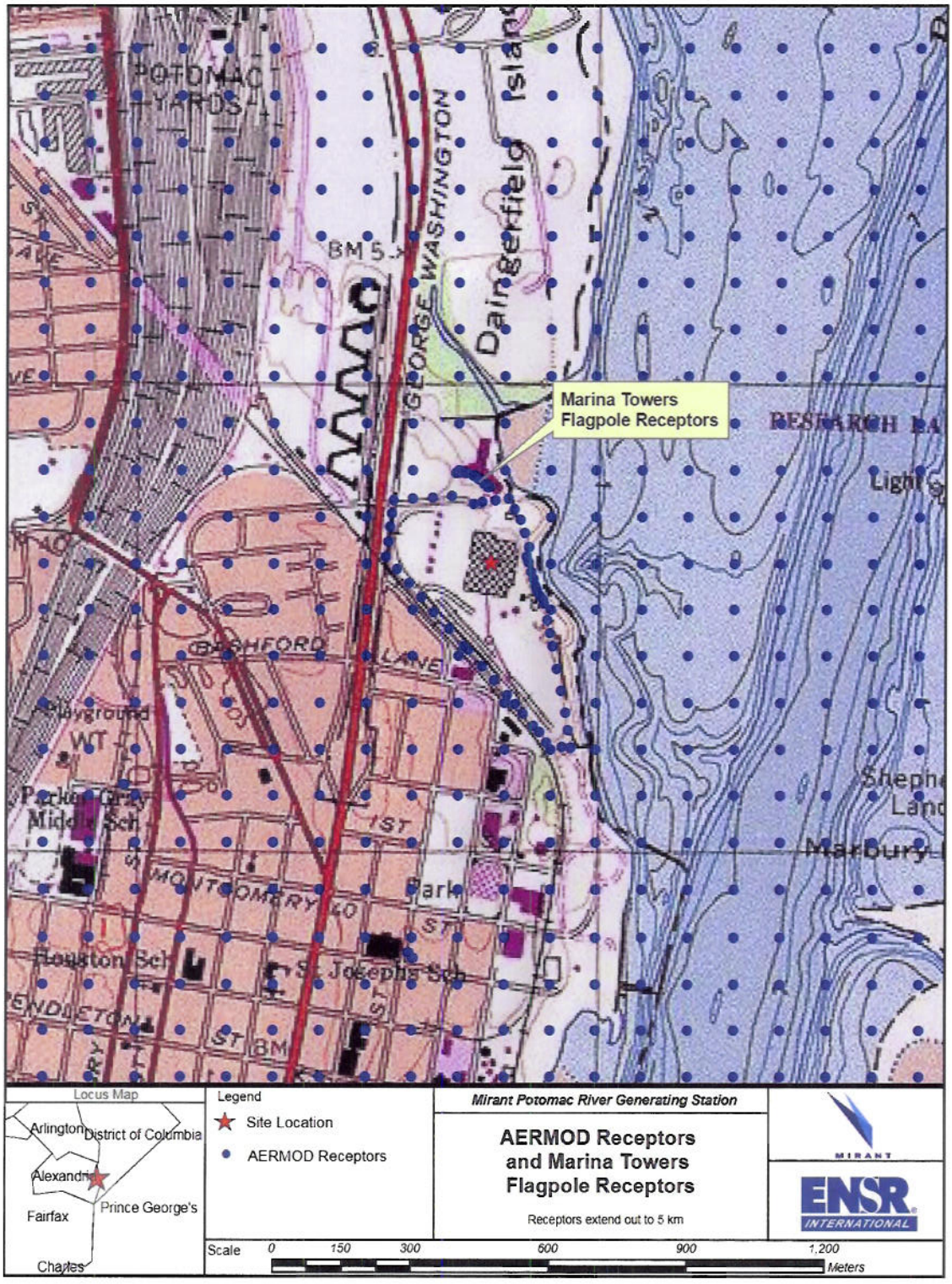


Figure 3-4 AERMOD Receptor Grid and Flagpole Receptors



3.5 Meteorological Data

For refined dispersion modeling, one year of on-site or five years of off-site representative meteorological data are required. For this application, five years of meteorological data will be used for input to AERMET, the meteorological preprocessor for AERMOD. Hourly surface meteorological data from the NWS Station at Reagan National Airport, Virginia will be used in addition to the upper air meteorological data from the NWS Met Station at Sterling, Virginia to develop the 5-year (1998-2002) AERMET data files (see Figure 3-5).

Meteorological data required for the AERMOD model partly consist of hourly values of wind speed, wind direction, and ambient temperature. Since the AERMOD dispersion algorithms are based on atmospheric boundary layer dispersion theory, additional boundary layer parameters are required. These parameters include sensible heat flux, surface friction velocity, convective velocity scale, vertical potential temperature gradient, convective and mechanical mixing heights, Monin-Obukhov length, surface roughness length, Bowen ratio, and albedo. A portion of these boundary layer parameters, as well as hourly wind and temperature profiles of the atmosphere, are estimated using surface parameters and upper air soundings. The base elevation of the primary surface station also is required by AERMOD. The base elevation of the Reagan National Airport will be used in AERMOD.

The AERMET meteorological pre-processor (version 02222) will be used to process data required for AERMOD. Site characteristics of the power plant site such as surface roughness, albedo, and Bowen ratio will be included in the input control file to AERMET.

3.5.1 Site Characteristics

Table 3-4 shows the land use site characteristics surrounding the Mirant facility. These characteristics were determined by examining a 3-kilometer radius area surrounding the site (centered at the boiler building). The area was then divided into 4 directional sectors for specifying site characteristics (see Figure 3-6 and Figure 3-7).

Table 3-4 Land Use Characteristics Surrounding the Mirant Site

Land-Use Type	Fractional Land-Use			
	Sector 1 (60°-120°)	Sector 2 (120°-180°)	Sector 3 (180°-350°)	Sector 4 (350°-60°)
Water	0.25	0.8	0	0.6
Deciduous	0.1	0.05	0.1	0.1
Grassland	0.2	0.05	0.1	0.15
Urban	0.45	0.1	0.8	0.15
Total % Land Use	1	1	1	1

Figure 3-5 Meteorological and Air Pollution Monitoring Stations

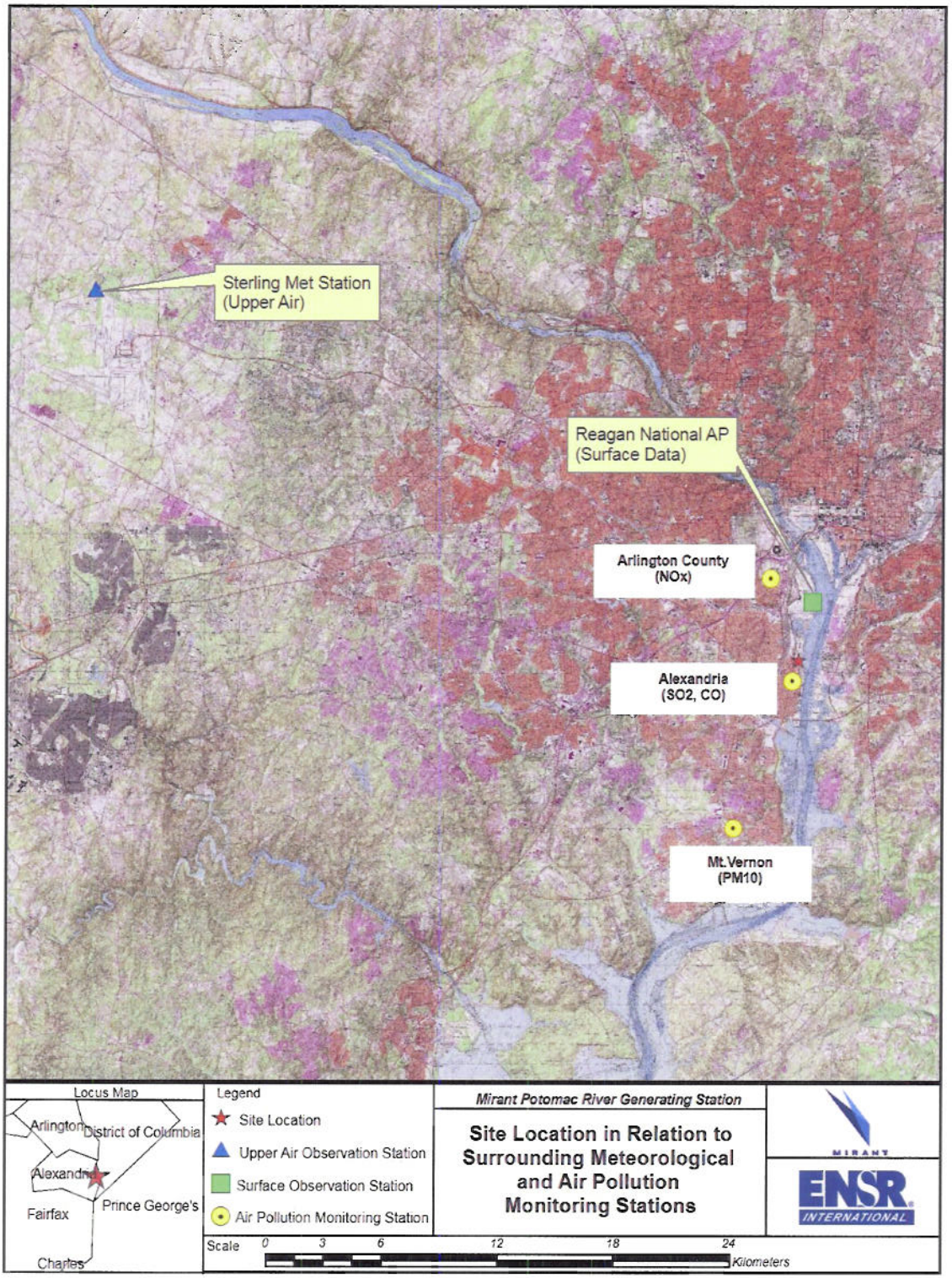


Figure 3-6 Sectors Indicating Land Use at the Mirant Site

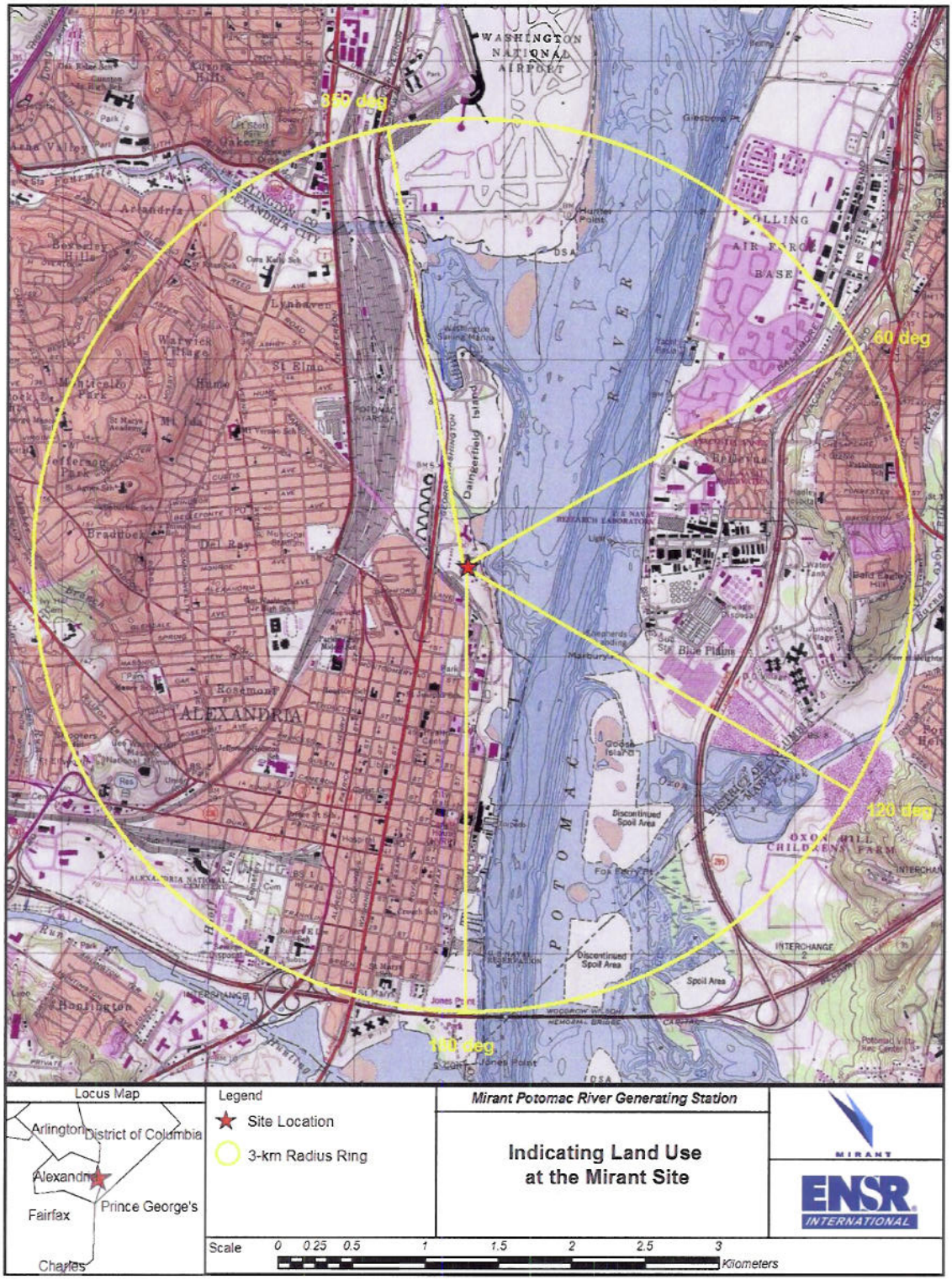
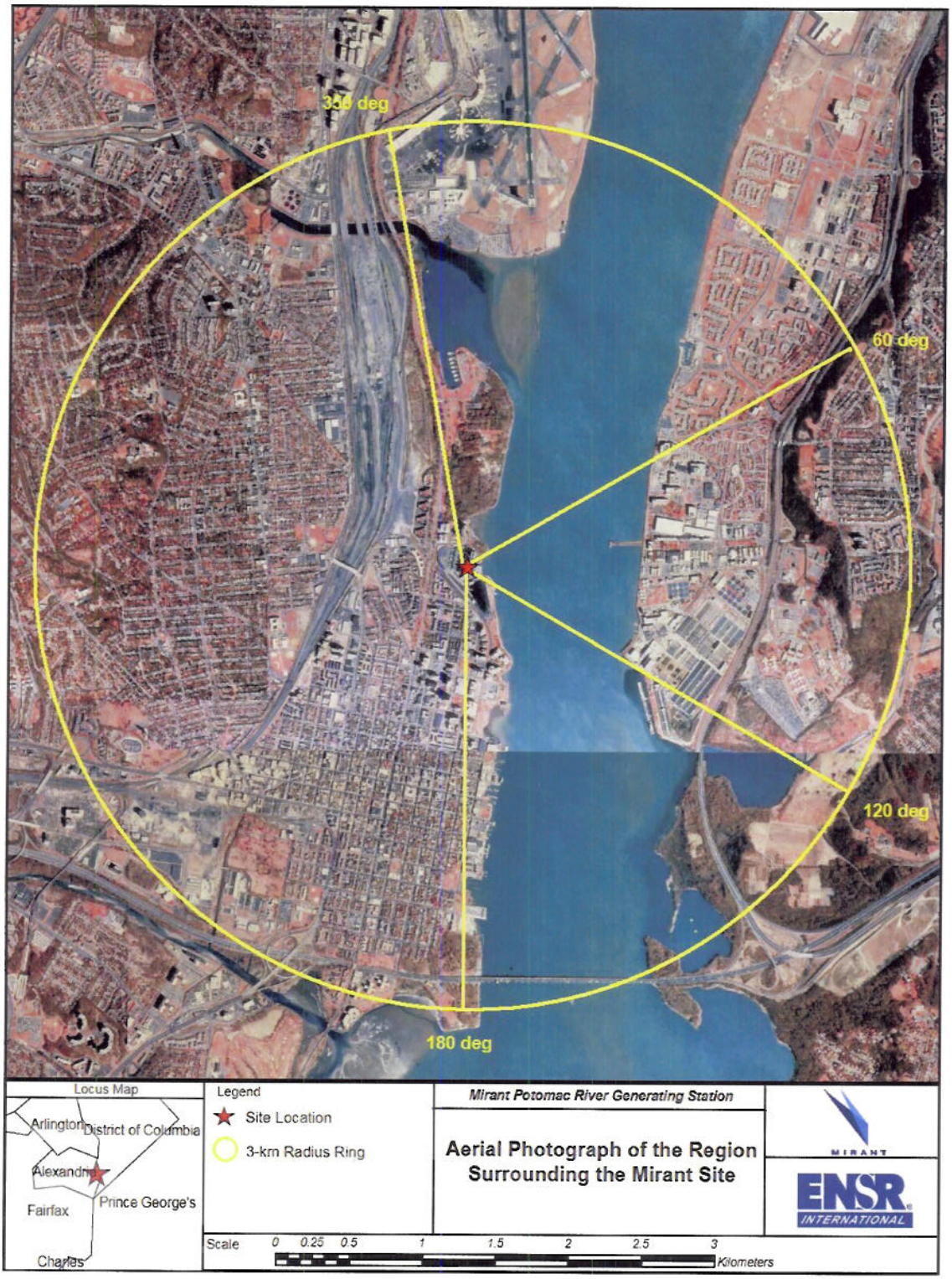


Figure 3-7 Aerial Photo of the Region Surrounding the Mirant Site



The seasonal values for each land classification that are needed based on the above sectors are provided in the AERMET user's guide (USEPA 1998) and summarized in Tables 3-5 through 3-7. Monthly weighted averages of albedo, surface roughness, and Bowen ratio based on the land classification for the above sectors will be calculated for five meteorological years. The Bowen ratio will have different annual values because of its dependency on moisture conditions. Each month will be classified as average, dry, or wet, based on monthly average precipitation data from Reagan National Airport compared to a 30 year average for each month. The calculated values then will be used for that month in determining the weighted average for the sector.

Table 3-5 Seasonal Albedo Values found in the AERMET User's Guide

Land-Use Type	Spring	Summer	Autumn	Winter
Water	0.12	0.10	0.14	0.20
Deciduous	0.12	0.12	0.12	0.50
Coniferous	0.12	0.12	0.12	0.35
Swamp	0.12	0.14	0.16	0.30
Cultivated Land	0.14	0.20	0.18	0.60
Grassland	0.18	0.18	0.20	0.60
Urban	0.14	0.16	0.18	0.35
Desert Shrubland	0.30	0.28	0.28	0.45

Table 3-6 Seasonal Surface Roughness Values found in the AERMET User's Guide

Land-Use Type	Spring	Summer	Autumn	Winter
Water	0.0001	0.0001	0.0001	0.0001
Deciduous	1.00	1.30	0.80	0.50
Coniferous	1.30	1.30	1.30	1.30
Swamp	0.20	0.20	0.20	0.05
Cultivated Land	0.03	0.20	0.05	0.01
Grassland	0.05	0.10	0.01	0.001
Urban	1.00	1.00	1.00	1.00
Desert Shrubland	0.30	0.30	0.30	0.15

Table 3-7 Seasonal Bowen Ratio Values found in the AERMET User's Guide

Land-Use Type	Average				Dry				Wet			
	Spring	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter
Water	0.1	0.1	0.1	1.5	0.1	0.1	0.1	2.0	0.1	0.1	0.1	0.3
Deciduous	0.7	0.3	1.0	1.5	1.5	0.6	2.0	2.0	0.3	0.2	0.4	0.5
Coniferous	0.7	0.3	0.8	1.5	1.5	0.6	1.5	2.0	0.3	0.2	0.3	0.3
Swamp	0.1	0.1	0.1	1.5	0.2	0.2	0.2	2.0	0.1	0.1	0.1	0.5
Cultivated Land	0.3	0.5	0.7	1.5	1.0	1.5	2.0	2.0	0.2	0.3	0.4	0.5
Grassland	0.4	0.8	1.0	1.5	1.0	2.0	2.0	2.0	0.3	0.4	0.5	0.5
Urban	1.0	2.0	2.0	1.5	2.0	4.0	4.0	2.0	0.5	1.0	1.0	0.5
Desert Shrubland	3.0	4.0	6.0	6.0	5.0	6.0	10.0	10.0	1.0	5.0	2.0	2.0

4.0 BACKGROUND AIR QUALITY

Ambient air quality data are used to represent the contribution to total ambient air pollutant concentrations from non-modeled sources. Table 4-1 shows locations and the measured concentrations over the past three years (2001-2003) of the closest air pollution monitors to the Mirant power plant. Background concentrations of SO_2 and CO were based on the Alexandria City, VA air quality monitoring station data located 1 km to the SW of the power plant. The Alexandria site is classified as residential land use and is in an urban area.

Background air quality concentrations of NO_2 were based on the Arlington County monitoring data. The monitoring station is located 4.4 km to the NW of the Mirant Potomac facility. The Arlington site is classified as commercial land use and located in an urban area.

Ambient background air quality concentrations of PM_{10} were based on the Mount Vernon, VA monitoring data. The monitoring station is located 9 km to the SSW of the Mirant Potomac facility. The Mount Vernon site is classified as residential land use and located in a suburban area.

Table 4-1 Summary of the Background Air Quality Data

Pollutant	Monitor Site	Averaging Period	Measured Concentrations ($\mu g/m^3$)*			NAAQS ($\mu g/m^3$)
			2001	2002	2003	
SO_2	517 N Saint Asaph St, Alexandria City, VA	3-hour	207.0	238.4*	186.0	1300
		24-hour	57.6	55.0	60.3*	365
		Annual	15.7*	15.7*	15.7*	80
PM_{10}	2675 Sherwood Hall Lane, Mt.Vernon, VA	24-hour	35	40	42*	150
		Annual	18	19	21*	50
NO_2	S 18th And Hayes St, Arlington County, VA	Annual	41.4	41.4	48.9*	100
CO	517 N Saint Asaph St, Alexandria City, VA	1-hour	4945.0*	4600.0	4025.0	40,075
		8-Hour	2760.0	2760.0	3220.0*	10,305

* Short-term and annual values are highest in each year.
Short-term concentrations reported as highest of the second highest and annual concentrations reported as mean.

5.0 DOCUMENTATION OF RESULTS

The report that documents the air quality impact analysis will describe the input data, the modeling procedures, and the results in tabular and graphical form. Much of the information regarding locations, plot plans, etc., associated with the Project that is included in this modeling protocol will be included in the air quality impact analysis report.

The document will be presented in loose-leaf format in a 3-ring binder so that additions or revisions can easily be made. Any process information deemed to be confidential by Mirant Corporation will be so noted.

Three copies of the final air quality modeling report will be submitted to the Virginia DEQ Central Office. Additional copies for distribution to USEPA Region III will be provided, if necessary.

The computer files associated with the air quality analysis will be submitted on a single CD-ROM. All meteorological and monitoring data will be presented so that a reviewer can completely reconstruct the entire modeling demonstration on an IBM-compatible PC. Descriptions of files on the CD will be included in the computer documentation, and the use of binary files will be avoided to promote portability of the files to other computer systems.

6.0 REFERENCES

EPA 1985. *Guideline for the Determination of Good Engineering Practice Stack Height (Technical Support Document for the Stack Height Regulations) - Revised.* EPA-450/4-80-023R, U.S. Environmental Protection Agency, Research Triangle Park, NC 27711.

EPA 1990. *New Source Review Workshop Manual.* Draft October 1990. U.S. Environmental Protection Agency, Research Triangle Park, NC 27711.

EPA 1997. *Guideline on Air Quality Models (Revised).* EPA-450/2-78-027R, U. S. Environmental Protection Agency, Research Triangle Park, NC 27711.

EPA 1998. *Revised Draft User's Guide for the AERMOD Meteorological Preprocessor (AERMET).* U. S. Environmental Protection Agency, Research Triangle Park, NC 27711.

EPA, 2004. Control of Mercury Emissions from Coal-Fired Electric Utility Boilers. Air Office of Research and Development, February 27. EPA's Technology Transfer Network Air Toxics Website/Electric Utility Steam Generating Units NESHAPS

Paine, R.J., R.F. Lee, R. Brode, R.B. Wilson, A.J. Cimorelli, S.G. Perry, J.C. Weil, A. Venkatram and W. Peters, 1998. Model Evaluation results for AERMOD. EPA website www.epa.gov/scram001

Standards of Performance for Toxic Pollutants 9VAC5-60-230
http://leg1.state.va.us/cgi-bin/legp504.exe?000+reg+9VAC5-60-230

APPENDIX A

CONSENT ORDER REGARDING A DOWNWASH STUDY

&

VA DEQ COMMENT LETTER ON THE MODELING PROTOCOL

MIRANT POTOMAC RIVER GENERATING STATION

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

W. Tayloe Murphy, Jr.
Secretary of Natural Resources

Street address: 629 East Main Street, Richmond, Virginia 23219
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Fax (804) 698-4500 TDD (804) 698-4021
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Robert G. Burnley
Director

(804) 698-4000
1-800-592-5482

February 10, 2005

Dave Shea
Sr. Program Manager
ENSR Corporation
2 Technology Park Drive
Westford, MA 01886

Dear Mr. Shea:

I am writing this letter in response to your Protocol for Modeling the Effects of Downwash from the Mirant's Potomac River Power Plant dated October 2004. As part of Department of Environmental Quality (DEQ)'s review of this document, I have reviewed and considered comments on this protocol from a local neighborhood association and the city of Alexandria.

First of all, I would like to state that the specific Potomac River Power Plant emissions data used in the proposed Downwash Study will be agreed to by the Northern Virginia Regional Office staff. PM2.5 emissions will not be considered due to the lack of an EPA-approved analysis model or procedure. However, PM10 (analyzed as a surrogate for PM2.5), as well as the other specified criteria pollutants will be considered for the total plant operation to include coal and ash yards in the study. You should work closely with the regional staff to develop the worst case emissions and stack parameters for this facility.

As to the proposed model, AERMOD, DEQ has requested approval to use this model since it is still not promulgated and has received it from the USEPA, Region III, Regional Director. Although there are technical disagreements among professional modelers about the location to be examined for land use characteristics, the center of this study should be the placed at the power plant.

Upon reviewing topographic maps and aerial photographs of the area, the Marina Towers as well as some other high rise buildings that are close by should be addressed in the analysis to determine downwash characteristics to be included in the AERMOD model runs. I realize that this will take some time to gather additional dimensions of these buildings.

Also, several discrete receptors have been suggested by the local citizens. In order to determine the worst case concentrations in the area, prepare a refined modeling area receptor grid out to 5 km with receptors placed every 100 m. This grid of receptors should be representative of the air quality for all the specific discrete receptors requested by the populace in the area. If the concentration gradient is decreasing at the 5 km distance and the concentrations are less than the air quality standards promulgated by EPA and this agency, then the modeling area is limited at that point. This receptor grid should also include flag pole receptors for all nearby raised structures. The flagpole receptors should be placed at access points on each level or floor of the nearby raised structures.

After responding to this letter with your amended protocol by March 15, I will supply you with the appropriate monitored background values for the modeled criteria pollutants.

Sincerely yours,

Kenneth L. McBee
Air Quality Modeler

Cc: Larry Labrie, Mirant Corp
John McKie, Air Permitting Engineer, NVRO
Terry Darton, Air Permitting Manager, NVRO

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

W. Tayloe Murphy, Jr.
Secretary of Natural Resources

Northern Virginia Regional Office
13901 Crown Court
Woodbridge, VA 22193-1453
(703) 583-3800 *fax* (703) 583-3801
www.deq.state.va.us

Robert G. Burnley
Director

Jeffery A. Steers
Regional Director

COMMONWEALTH OF VIRGINIA
STATE AIR POLLUTION CONTROL BOARD

ORDER BY CONSENT

ISSUED TO

MIRANT POTOMAC RIVER, LLC
Registration No. 70228

SECTION A: Purpose

This is a Consent Order issued under the authority of Va. Code § § 10.1-1307D and 10.1-1307.1, between the Board and Mirant Potomac River, LLC for the purpose of ensuring compliance with ambient air quality standards incorporated at 9 VAC Chapter 30 and Va. Code § 10.1-1307.3(3) requiring certain emissions modeling and analysis related to the Potomac River Power Station located in Alexandria, Virginia.

SECTION B: Definitions

Unless the context clearly indicates otherwise, the following words and terms have the meanings assigned to them below:

1. "Va. Code" means the Code of Virginia (1950), as amended.

2. "Board" means the State Air Pollution Control Board, a permanent collegial body of the Commonwealth of Virginia as described in Va. Code §§ 10.1-1301 and 10.1-1184.

3. "Department" or "DEQ" means the Department of Environmental Quality, an agency of the Commonwealth of Virginia as described in Va. Code § 10.1-1183.

4. "Director" means the Director of the Department of Environmental Quality.

5. "Order" means this document, also known as a Consent Order.

6. "Mirant," means Mirant Potomac River, LLC, a limited liability company qualified to do business in Virginia. Mirant Potomac River, LLC is owned Mirant Corporation and operated by Mirant Mid-Atlantic, LLC.

7. "Facility" means the Potomac River Generating Station owned and operated by Mirant located at 1400 North Royal Street, Alexandria, Virginia, 22314. The facility is a five unit, 488 MW coal-fired electric generating plant.

8. "NVRO" means the Northern Virginia Regional Office of DEQ, located in Woodbridge, Virginia.

9. "The Permit" means the Stationary Source Permit to Operate issued by DEQ to the facility on September 18, 2000, pursuant to 9 VAC 5-80-800, *et seq*.

10. "Marina Towers" means a multiple unit residential condominium building located at 501 Slaters Lane, Alexandria, Virginia, in close proximity to the facility.

11. "Downwash" means the effect that occurs when aerodynamic turbulence induced by nearby structures causes pollutants from an elevated source (such a smokestack) to be mixed rapidly toward the ground resulting in higher ground-level concentrations of pollutants.

12. "NAAQS" means the primary national ambient air quality standards established by the U.S. Environmental Protection Agency for certain pollutants, including sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), ozone, and particulate matter (PM), pursuant to § 109 of the federal Clean Air Act, 42 USC § 7409, set forth at 40 CFR Part 50 and incorporated at 9 VAC Chapter 30. NAAQS are established at concentrations necessary to protect public health with an adequate margin of safety.

13. "NOx" means oxides of nitrogen, which is a pollutant resulting from the combustion of fossil fuels and a precursor to the formation of ozone.

14. "PM_{10}" means particulate matter with an aerodynamic diameter less than or equal to 10 micrometers and is a pollutant resulting from, among other things, the combustion of fossil fuels.

SECTION C: Findings of Fact and Conclusions of Law

1. In order to ensure compliance with the Northern Virginia area's National Ambient Air Quality Standard (NAAQS) for ozone, the Department is in the process of revising the facility's Stationary Source Permit to Operate for the purpose of clarifying the facility's ozone season

(May 1 through September 30) emission requirements for NOx. A public hearing on the proposed permit revision was held in Alexandria, Virginia, on the evening of April 12, 2004.

2. Among the comments offered at the public hearing by Alexandria residents was that DEQ should require Mirant to perform comprehensive modeling to assess the impact of emissions from the facility on the area in the immediate vicinity of the facility.

3. At or about the time of the public hearing, certain residents of Alexandria, Virginia, provided the Department with a document entitled "Screening-Level Modeling Analysis of the Potomac River Power Plant Located in Alexandria, Virginia" prepared by Sullivan Environmental Consulting, Inc., dated March 29, 2004 (the Sullivan Screening). The Sullivan Screening was commissioned by, among others, certain residents of Marina Towers for the purpose of assessing whether emissions from the facility may cause exceedances of certain NAAQS at Marina Towers as a result of "downwash." The Sullivan Screening concluded that, "on average, meteorological conditions associated with plume impaction conditions on the Marina Towers condominium were screened to occur as often as 1,200 hours per year."

4. Although the Sullivan Screening does not establish conclusively that emissions from the facility result in exceedances of the NAAQS at Marina Towers, the Department believes that the results of the Sullivan Study warrant that further comprehensive analysis be conducted in accordance with DEQ and EPA approved modeling procedures in order to more fully determine the effect of emissions from the facility on the ambient air quality at Marina Towers and in the area in the immediate vicinity of the facility.

SECTION D: Agreement and Order

Accordingly, the Board, by virtue of the authority granted it in Va. Code §§ 10.1-1307 D and 10.1-1307.1 orders Mirant, and Mirant agrees, to perform the actions described in this section of the Order:

1. Mirant shall perform a refined modeling analysis to assess the effect of "downwash" from the facility on ambient concentrations of SO_2, NO_2, CO, and PM_{10} for comparison to the applicable NAAQS in the area immediately surrounding the facility. In addition, Mirant shall perform a refined modeling analysis to assess the effect of "downwash" from the facility on ambient concentrations of mercury for comparison to the applicable Standards of Performance for Toxic Pollutants set forth in 9 VAC 5-60-200, *et seq.*, in the area immediately surrounding the facility.

2. The protocol and methodology for the modeling analysis shall be in accordance with EPA and DEQ methods and shall be approved by DEQ prior to commencement of the modeling. Mirant shall submit a proposed modeling protocol and methodology to Kenneth L. McBee, DEQ Air Modeling Program Coordinator, 629 E. Main St., Richmond VA 23219, within twenty-one (21) days of the effective date of this Order.

3. Mirant shall perform the modeling analysis immediately upon receiving written approval of the modeling protocol and methodology from DEQ. Mirant shall submit the results of the modeling analysis to Mr. McBee and the Director of the Department's Northern Virginia Regional Office no later than sixty (60) days after Mirant receives written approval of the modeling protocol and methodology.

4. In the event the modeling analysis indicates that emissions from the facility may cause exceedances of the NAAQS for SO_2, NO_2, CO, or PM_{10}, or exceedances of the Standards of Performance for Toxic Pollutants for mercury in the area immediately surrounding the facility, DEQ shall require Mirant to submit to DEQ, within ninety (90) days of submitting the modeling analysis, a plan and schedule to eliminate and prevent such exceedances on a timely basis. Upon review and approval of that plan and schedule by DEQ, the approved plan and schedule shall be incorporated by reference into this Order.

5. Mirant agrees to waive any objections it may otherwise be entitled to assert under law should DEQ seek to incorporate the approved plan and schedule into the facility's permit.

Section E: Administrative Provisions

1. The Board may modify, rewrite, or amend this Order with the consent of Mirant for good cause shown by Mirant, or after a proceeding as required by the Administrative Process Act for a case decision.

2. This Order addresses only those issues specifically identified herein. This Order shall not preclude the Board or the Director from taking any action authorized by law, including, but not limited to seeking subsequent remediation of the facility as may be authorized by law and/or taking subsequent action to enforce the terms of this Order. This order shall not preclude appropriate enforcement actions by other federal, state or local regulatory agencies for matters not addressed herein.

3. Solely for the purposes of the execution of this Order, for compliance with this Order, and for subsequent actions with respect to this Order, Mirant consents to the jurisdictional allegations and conclusions of law contained herein.

4. Mirant declares it has received fair and due process under the Administrative Process Act, Va. Code §§ 2.2-4000 *et seq.*, and the Air Pollution Control Law and it waives the right to any hearing or other administrative proceeding authorized or required by law or regulation, and to any judicial review of any issue of fact or law contained herein. Nothing herein shall be construed as a waiver of the right to any administrative proceeding for, or to judicial review of, any action taken by the Board to modify, rewrite, amend, or enforce this Order, or any subsequent deliverables required to be submitted by Mirant and approved by the Department, without the consent of Mirant.

5. Failure by Mirant to comply with any of the terms of this Order shall constitute a violation of an order of the Board. Nothing herein shall waive the initiation of appropriate enforcement actions or the issuance of additional orders as appropriate by the Board or Director as a result of such violations.

6. If any provision of this Order is found to be unenforceable for any reason, the remainder of the Order shall remain in full force and effect.

7. Mirant shall be responsible for failure to comply with any of the terms and conditions of this Order unless compliance is made impossible by earthquake, flood, other acts of God, war, strike, or other such circumstance. Mirant must show that such circumstances resulting in noncompliance were beyond its control and not due to a lack of good faith or diligence on its part. Mirant shall notify the Director, NVRO, in writing when circumstances are anticipated to occur, are occurring, or have occurred that may delay compliance or cause noncompliance with any requirement of this Order. Such notice shall set forth:

a. The reasons for the delay or noncompliance;

b. The projected duration of any such delay or noncompliance;

c. The measures taken and to be taken to prevent or minimize such delay or noncompliance; and

The timetable by which such measures will be implemented and the date full compliance will be achieved.

Failure to so notify the Director, NVRO, in writing within 24 hours of learning of any condition above, which Mirant intends to assert will result in the impossibility of compliance, shall constitute a waiver of any claim of inability to comply with a requirement of this Order.

8. This Order is binding on the parties hereto, parent corporations, or their successors in interest, designees, assigns.

9. This Order shall become effective upon execution by both the Director of the Department of Environmental Quality or his designee and Mirant.

10. This Order shall continue in effect until:

a. Mirant petitions the Director or his designee to terminate the order after it has completed all of the requirements of the Order and the Director or his designee approves the termination of the Order; or

b. The Director or Board terminates the Order in his or its sole discretion upon 30 days written notice to Mirant.

Termination of this Order, or of any obligation imposed in this Order, shall not operate to relieve Mirant from its obligation to comply with any statute, regulation, permit condition, other order, certificate, certification, standard, or requirement otherwise applicable.

AND IT IS ORDERED this 23rd day of SEPTEMBER 2004.

By: _____
Robert G. Burnley, Director
Department of Environmental Quality

Mirant Potomac River, LLC, voluntarily agrees to the issuance of this Order.

MIRANT POTOMAC RIVER, LLC

by: _____
Lisa D. Johnson, President

The foregoing instrument was signed and acknowledged before me on this 17th day of Sept. 2004 by Lisa D. Johnson of Mirant Potomac River, LLC, in the City of County of Prince George, Commonwealth of Virginia.

_____
Notary Public

My Commission expires: 06/07/05

APPENDIX B

PARTICULATE EMISSION CALCULATIONS

MIRANT POTOMAC RIVER GENERATING STATION

Mirant Potomac River, LLC
Ash Silo Vent Secondary Filtration - Fugitive Dust Emission Calculations

FLY ASH EMISSION CALCULATIONS

Fly Ash Assumptions

Total Ash Shipped in trucks =	631	tpd (according to Mirant)			164,060 ton ash/yr
Est. Fly ash shipped in trucks =	593				
Est. Bottom ash shipped in trucks=	38				
Target moisture for fly ash	20	%			
Worse case moisture for fly ash=	10	%			
Daily Ash generated by Boilers	480	tpd			
Estimated % that is bottom ash	6%				
Estimated % that is fly ash	94%				
Estimated Avg wt of ash in trucks	22	tons @	20%	moisture	
Truck Loading in Silo:	8	min			
Truck Washing	15 - 30	min			
Ash hauling	8	hr/day			
	5	days/wk			
	52	wk/yr	260	days/yr	
Trucks onsite	4	hr/day			
Avg number of trucks hauling ash	7	trucks/day	7,280	truck trips/yr	160,160 ton ash/yr
Avg number of truck trips	4	trips/day			
Peak number of trucks hauling ash	10	trucks/day	40	truck trips/day	
Peak number of truck trips	4	trips/day			

Fly Ash Emissions from Baghouse on top of loading silos

2 - Silo's	Flow of pneumatic air with fly ash into silo	7800	cfm (Mirant - 2 x (2,700 + 1,200)
	Ash Loading into silo	480	tpd (from daily ash generated by boilers)
	Baghouse collection efficiency	99.0%	(based on outlet grain loading)
	Outlet Baghouse emissions (assumed)	0.1	grains/acf
	Estimated PM/PM-10 emissions	780	grains/min
	Estimated PM/PM-10 hourly emissions	6.69	lb/hr
	Estimated PM/PM-10 yearly emissions	29.28	tpy

Bottom Ash Emissions from Baghouse on top of loading silo

1 - Silo	Flow of pneumatic air with fly ash into silo	5400	cfm (from Mirant)
	Outlet Baghouse emissions (assumed)	0.015	grains/acf (assumed based on visual comparison to fly ash silo baghouses)
	Estimated PM/PM-10 emissions	81	grains/min
	Estimated PM/PM-10 hourly emissions	0.69	lb/hr
	Estimated PM/PM-10 yearly emissions	3.04	tpy

Total Ash Emissions (All three silos)

		—PM-10 Emissions—		—PM Emissions—	
		lb/hr	tpy	lb/hr	tpy
Ash Silo Secondary Filtration	Existing	7.4	32.3	7.4	32.3

Represents existing emissions

Mirant Potomac River, LLC
Ash Loader Upgrade - Fugitive Dust Emission Calculations

FLY ASH EMISSION CALCULATIONS

Fly Ash Emissions from Truck Loading in Silos

	PM10		PM	
Existing Peak Estimate	2.17E-04	EF lb/ton	4.58E-04	EF lb/ton
	880	tpd fly ash loaded	880	tpd fly ash loaded
	236	tph fly ash loaded	236	tph fly ash loaded
	0.051	lbs/hr fly ash emissions	0.108	lbs/hr fly ash emissions
	0.035	tpy fly ash emissions	0.075	tpy fly ash emissions

Emission Factor Calculations (1)

UEF PM (lb/ton) = k x 0.0032 x ((U/5)^1.3)/((M/2)^1.4)

Assume:

k (particle size multiplier) =	0.35	for PM-10 &	0.74 for PM
U (mean wind speed) =	8	miles/hour average wind speed within the silo enclosures (assumed)	
M (moisture content) =	20	% (target moisture content of fly ash after pug mill)	
M (moisture content) =	10	% (worse case moisture content of fly ash after pug mill)	

NOTES:

'(1) AP-42 Section 13.2.4 Aggregate Handling and Storage Piles

Fly Ash Assumptions

Total Ash Shipped in trucks =	631	tpd (according to Mirant)	
Est. Fly ash shipped in trucks =	593		
Est. Bottom ash shipped in trucks=	38		
Target moisture for fly ash	20	%	
Worse case moisture for fly ash=	10	%	
Daily Ash generated by Boilers	480	tpd	
Estimated % that is bottom ash	6%		
Estimated % that is fly ash	94%		
Estimated Avg wt of ash in trucks	22	tons @	20% moisture
Truck Loading in Silo:	8	min	
Truck Washing	15 - 30	min	
Ash hauling	8	hr/day	
	5	days/wk	
	52	wk/yr	
Trucks onsite	4	hr/day	
Avg number of trucks hauling ash	7	trucks/day	
Avg number of truck trips	4	trips/day	
Peak number of trucks hauling ash	10	trucks/day	
Peak number of truck trips	4	trips/day	

Total Ash Emissions

		---PM-10 Emissions---		---PM Emissions---	
		lb/hr	tpy	lb/hr	tpy
Ash Loader Upgrade	Existing	0.05	0.04	0.11	0.07

Mirant Potomac River, LLC
Ash Loading System Dust Suppression - Fugitive Dust Emission Calculations

FLY ASH EMISSION CALCULATIONS

Fly Ash Emissions from Truck Loading in Silos

	PM10		PM	
Existing Peak Estimate	2.17E-04	EF lb/ton	4.58E-04	EF lb/ton
	880	tpd fly ash loaded	880	tpd fly ash loaded
	236	tph fly ash loaded	236	tph fly ash loaded
	0.051	lbs/hr fly ash emissions	0.108	lbs/hr fly ash emissions
	0.035	tpy fly ash emissions	0.075	tpy fly ash emissions

Emission Factor Calculations (1)

UEF PM (lb/ton) = k x 0.0032 x ((U/5)^1.3)/((M/2)^1.4)
CEF PM (lb/ton) = UEF (lb/ton) x ((100 - removal efficiency (%))/100)

Assume:

k (particle size multiplier) =	0.35	for PM-10 & 0.74 for PM	
U (mean wind speed) =	8	miles/hour average wind speed within the silo enclosures (assumed)	
M (moisture content) =	20	% (target moisture content of fly ash after pug mill)	
M (moisture content) =	10	% (worse case moisture content of fly ash after pug mill)	
Emission control removal efficiency =	65	%	Water spray system (estimate from Bob Coburn at Benetech)

NOTES:
'(1) AP-42 Section 13.2.4 Aggregate Handling and Storage Piles

Fly Ash Assumptions

Total Ash Shipped in trucks =	631	tpd (according to Mirant)	
Est. Fly ash shipped in trucks =	593		
Est. Bottom ash shipped in trucks=	38		
Target moisture for fly ash	20	%	
Worse case moisture for fly ash=	10	%	
Daily Ash generated by Boilers	480	tpd	
Estimated % that is bottom ash	6%		
Estimated % that is fly ash	94%		
Estimated Avg wt of ash in trucks	22	tons @	20% moisture
Truck Loading in Silo:	8	min	
Truck Washing	15 - 30	min	
Ash hauling	8	hr/day	
	5	days/wk	
	52	wk/yr	
Trucks onsite	4	hr/day	
Avg number of trucks hauling ash	7	trucks/day	
Avg number of truck trips	4	trips/day	
Peak number of trucks hauling ash	10	trucks/day	
Peak number of truck trips	4	trips/day	

Total Ash Emissions

		—PM-10 Emissions—		—PM Emissions—	
		lb/hr	tpy	lb/hr	tpy
Ash Loading Dust Suppression	Existing	0.05	0.04	0.11	0.07

Mirant Potomac River, LLC
Fence - Fugitive Dust Emission Calculations

COAL EMISSIONS CALCULATIONS

Wind Erosion Actual Emissions (for coal emissions)

		—PM-10 Emissions—		—PM Emissions—	
Golder coal pile wind erosion calculations OK		lb/hr	tpy	lb/hr	tpy
6 acre active coal pile (worst case)	Existing (6 acres)	4.9	3.0	9.8	5.9
	Existing (4 acres)	3.3	2.0	6.5	4.0
After Installation of Wind Screen (see calculations below)					
6 acre active coal pile (worst case)	Projected	0.9	1.0	1.7	2.1

Wind Erosion

Reference: Control of Open Fugitive Dust Sources, Section 4.1.3, EPA-450/3-98-008
[Wind Emissions From Continuously Active Piles]

E (lb PM per day per acre) = 1.7 (s/1.5) (365-p/235) (f/15)

where:

	s =	4.8	silt content % [from AP-42 Table 13.2.4-1 (coal as received at coal-fired power plant)
	p =	120	number of days with >0.01 inches precip. per year [from AP-42 Figure 13.2.2-1]
Prior to Installation of Windscreen	f=	28.4	percentage of time that wind speed exceeds 5.4 m/s at mean pile height [from Washington, DC National Airport wind data 1988-1992]
After Installation of Windscreen	f =	27.4	Estimate for percentage of time wind speed exceeds 5.4 m/s after installation of wind screen
	E =	10.4	lb PM per day per acre
	E =	5.2	lb PM-10 per day per acre [using PM-10 to PM ratio of 0.5 from EPA-450/3-98-008]

Source Name	Coal pile size (acres)	Projected Emissions (lb PM_{10}/hr)	Projected Emissions (lb PM/hr)	Projected PM_{10} Emissions (tpy)	Projected PM Emissions (tpy)
Active Coal Storage Pile (Worst Case)	4.0	0.9	1.7	1.0	2.1

Mirant Potomac River, LLC
Coal Stack-Out Conveyor System - Fugitive Dust Emission Calculations

COAL EMISSIONS CALCULATIONS

Total Coal Emissions (Peak)

	---PM-10 Emissions---		---PM Emissions---	
	lb/hr	tpy	lb/hr	tpy
Breaker conveyor dump to coal pile Existing	0.05	0.20	0.10	0.42

Emission Factor Calculations for Coal (1)

UEF PM (lb/ton) = k x 0.0032 x ((U/5)^1.3)/((M/2)^1.4)
CEF PM (lb/ton) = UEF (lb/ton) x ((100 - removal efficiency (%))/100)

Assume:

k (particle size multiplier) =	0.35 for PM-10 &	0.74 for PM	
U (mean wind speed) =	12 miles/hour for short term		4.38 miles/hr for annual average
M (moisture content) =	4.5 % (from AP-42 Table 13.2.4-1 for coal as-received at coal fired power plant)		
M (moisture content) =	18 % (based on dust reduction estimate provided by Bob Coburn/ Benetech)		

AVERAGE		***WORSE CASE (PEAK)***	
UEF PM-10 Emission Factor =	3.03E-04	UEF PM-10 Emission Factor =	1.12E-03
CEF PM-10 Emission Factor =	4.35E-05	CEF PM-10 Emission Factor =	1.61E-04
UEF PM Emission Factor =	6.41E-04	UEF PM Emission Factor =	2.37E-03
CEF PM Emission Factor =	9.20E-05	CEF PM Emission Factor =	3.41E-04

NOTES:
'(1) AP-42 Section 13.2.4 Aggregate Handling and Storage Piles

Coal Assumptions

Annual Coal Throughput	711,836	tpy
Hourly Coal Throughput	81	tph (assume coal processed 8760 hr/yr)
Percent of coal throughput to pile	50	% (assume rest goes into storage bunkers in boiler building)

Existing Coal Emissions from Dump to Coal Pile from Breaker (drop from enclosed conveyor onto pile)

	PM10		PM	
Annual	3.03E-04	EF lb/ton	6.41E-04	EF lb/ton
	975	tpd coal dumped on pile	975	tpd coal dumped on pile
	41	tph coal dumped on pile	41	tph coal dumped on pile
	0.012	lbs/hr coal emissions	0.026	lbs/hr coal emissions
	0.054	tpy coal emissions	0.114	tpy coal emissions
	PM10		PM	
Peak Estimate	1.12E-03	EF lb/ton	2.37E-03	EF lb/ton
	975	tpd coal dumped on pile	975	tpd coal dumped on pile
	41	tph coal dumped on pile	41	tph coal dumped on pile
	0.046	lbs/hr coal emissions	0.096	lbs/hr coal emissions
	0.200	tpy coal emissions	0.423	tpy coal emissions

Mirant Potomac River, LLC
Railcar dumper - Fugitive Dust Emission Calculations

COAL EMISSIONS CALCULATIONS

SUMMARY OF FUGITIVE AND EXISTING PARTICULATE MATTER EMISSIONS FROM COAL

Total Coal Emissions (Peak)

		---PM-10 Emissions---		---PM Emissions---	
		lb/hr	tpy	lb/hr	tpy
Rail Car dump in partial enclosure	Existing	0.12	0.06	0.26	0.14

Rail Car Dump in Partial Enclosure - wind speed assumed to be 5 miles/hr

Annual Coal Throughput	711,836	tpy
Hourly Coal Throughput	684	tph (assume coal dumped 4 hr/day)
Partial Enclosure Control Efficiency	50	%
Daily Coal Unloading	4	hr/day
Weekly Coal Unloading	5	day/week
Annual Coal Unloading	52	wk/yr

Emission Factor Calculations for Coal in Partial Enclosure for Rail Car Dumping (1)

UEF PM (lb/ton) = k x 0.0032 x ((U/5)^1.3)/((M/2)^1.4)
CEF PM (lb/ton) = UEF (lb/ton) x ((100 - removal efficiency (%))/100)

Assume:

k (particle size multiplier) =	0.35	for PM-10 &	0.74	for PM
U (mean wind speed) =	5	miles/hour for short term	5	miles/hr for annual average
M (moisture content) =	4.5	% (from AP-42 Table 13.2.4-1 for coal as-received at coal fired power plant)		
Emission Reduction	75%	% (based on dust reduction estimate provided by Bob Coburn/ Benetech)		

AVERAGE

Existing PM-10 Emission Factor =	1.80E-04
CEF PM-10 Emission Factor =	4.50E-05
Existing PM Emission Factor =	3.80E-04
CEF PM Emission Factor =	9.51E-05

WORSE CASE (PEAK)

Existing PM-10 Emission Factor =	1.80E-04
CEF PM-10 Emission Factor =	4.50E-05
Existing PM Emission Factor =	3.80E-04
CEF PM Emission Factor =	9.51E-05

NOTES:
'(1) AP-42 Section 13.2.4 Aggregate Handling and Storage Piles

Existing Emissions from Railcar dumper

	PM10		PM	
Annual	1.80E-04	EF lb/ton	3.80E-04	EF lb/ton
	684	tph coal dumped in enclosure	684	tph coal dumped in enclosure
	0.123	lbs/hr coal emissions	0.260	lbs/hr coal emissions
	0.064	tpy coal emissions	0.135	tpy coal emissions

	PM10		PM	
Peak Estimate	1.80E-04	EF lb/ton	3.80E-04	EF lb/ton
	684	tph coal dumped in enclosure	684	tph coal dumped in enclosure
	0.123	lbs/hr coal emissions	0.260	lbs/hr coal emissions
	0.064	tpy coal emissions	0.135	tpy coal emissions

Road Section	Distance	Max. VMT/day	VMT/yr	PM_{10} Emissions			PM_{10} Emissions	
		Round Trip		24 hour	Annual	Annual	24 hour	Annual
	miles			lb/hr	lb/hr	ton/yr	g/s	g/s
From the edge of First Street to the Gate								
Gate to curve	0.177	14.167	2578.33	0.0739	0.0330	0.1447	0.009305	0.004163
Curve	0.005	0.379	68.94	0.0020	0.0009	0.0039	0.000249	0.000111
Curve to truck scale	0.022	1.742	317.12	0.0091	0.0041	0.0178	0.001145	0.000512
Truck scale to curve	0.028	2.273	413.64	0.0118	0.0053	0.0232	0.001493	0.000668
Curve	0.019	1.515	275.76	0.0079	0.0035	0.0155	0.000995	0.000445
Curve to flyash storage	0.047	3.788	689.39	0.0197	0.0088	0.0387	0.002488	0.001113
Total	0.30	23.864	4343.18	0.1244	0.0557	0.2438	0.015675	0.007013

	Empty truck wieght	10	ton	Input
	Ash per truck	22	ton	From Mirant
W	Average truck weight	16	ton	Calculated
	Maximum number of truck trips per day	40	trucks/day	From Mirant
	Total truck trips per year	7,280	trucks/yr	Calculated from Mirant data
sL	Silt loading	1.00	g/m^2	Input
C	Emission factor for exhaust brake wear and ti	0.00047	lb/VMT	AP-42
k	Particle size multiplier	0.016	lb/VMT	AP-42
P	Annual days with >0.01 inches rain	150	days	AP-42
N	Number of days in the averaging period	365	days	one year

Short term emissions:

$E = k \times (sL/2)^{0.65} \times (W/3)^{1.5} - C$

E = lb/VMT

Short term emissions:

$E = (k \times (sL/2)^{0.65} \times (W/3)^{1.5} - C) \times (1-P/4N)$ lb/VMT

APPENDIX C

GEP BUILDING DIMENSIONS PRODUCED BY LAKES ENVIRONMENTAL BPIP SOFTWARE

MIRANT POTOMAC RIVER GENERATING STATION

BPIP Output (meters)

```
SO BUILDHGT STACK1     35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT STACK1     35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT STACK1     35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT STACK1     35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT STACK1     35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT STACK1     35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDWID STACK1     36.38   39.88   54.75   68.00   79.00   87.75
SO BUILDWID STACK1     93.75   96.75   97.50   94.50   97.00   97.25
SO BUILDWID STACK1     94.25   88.75   80.75   69.75   56.88   42.34
SO BUILDWID STACK1     36.38   40.00   54.75   68.00   79.00   87.75
SO BUILDWID STACK1     93.75   97.00   97.00   94.50   97.00   97.00
SO BUILDWID STACK1     94.50   88.75   80.75   69.88   56.88   42.31
SO BUILDLEN STACK1    109.50   97.00   97.25   94.50   88.75   80.50
SO BUILDLEN STACK1     69.88   57.00   42.31   26.44   39.88   54.75
SO BUILDLEN STACK1     67.75   79.00   87.75   93.75   97.00   97.00
SO BUILDLEN STACK1    109.00   97.00   97.25   94.50   88.75   80.50
SO BUILDLEN STACK1     69.88   57.00   42.31   26.44   39.88   54.75
SO BUILDLEN STACK1     67.75   78.75   87.75   93.50   96.75   97.00
SO XBADJ    STACK1    -11.50  -10.00   -8.00   -5.75   -3.00   -0.75
SO XBADJ    STACK1      1.88    4.50    6.84    9.00   -4.12  -18.62
SO XBADJ    STACK1    -32.25  -45.25  -56.75  -66.50  -74.50  -80.00
SO XBADJ    STACK1    -97.50  -87.00  -89.50  -88.75  -85.75  -80.00
SO XBADJ    STACK1    -71.75  -61.50  -49.16  -35.47  -35.88  -36.38
SO XBADJ    STACK1    -35.50  -33.75  -31.00  -27.00  -22.50  -17.00
SO YBADJ    STACK1    -17.31  -15.81   -8.88   -1.75    5.75   12.88
SO YBADJ    STACK1     19.62   25.88   31.25   35.75   38.50   40.62
SO YBADJ    STACK1     41.62   41.12   39.62   36.88   32.94   28.02
SO YBADJ    STACK1     17.25   15.88    9.00    1.50   -5.75  -12.88
SO YBADJ    STACK1    -19.62  -25.75  -31.50  -35.75  -38.50  -40.75
SO YBADJ    STACK1    -41.75  -41.38  -39.62  -36.81  -32.94  -28.03

SO BUILDHGT STACK2     35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT STACK2     35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT STACK2     35.29   35.29   35.29   39.60   39.60   39.60
SO BUILDHGT STACK2     35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT STACK2     35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT STACK2     35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDWID STACK2     36.38   39.88   54.75   68.00   79.00   87.75
SO BUILDWID STACK2     93.75   96.75   97.50   94.50   97.00   97.25
SO BUILDWID STACK2     94.25   88.75   80.75   86.12   87.75   95.56
SO BUILDWID STACK2     36.38   40.00   54.75   68.00   79.00   87.75
SO BUILDWID STACK2     93.75   97.00   97.00   94.50   97.00   97.00
SO BUILDWID STACK2     94.50   88.75   80.75   69.88   56.88   42.31
SO BUILDLEN STACK2    109.50   97.00   97.25   94.50   88.75   80.50
SO BUILDLEN STACK2     69.88   57.00   42.31   26.44   39.88   54.75
SO BUILDLEN STACK2     67.75   79.00   87.75  121.75  121.50  117.50
SO BUILDLEN STACK2    109.00   97.00   97.25   94.50   88.75   80.50
SO BUILDLEN STACK2     69.88   57.00   42.31   26.44   39.88   54.75
SO BUILDLEN STACK2     67.75   78.75   87.75   93.50   96.75   97.00
SO XBADJ    STACK2    -36.00  -34.00  -31.00  -27.00  -22.00  -16.50
SO XBADJ    STACK2    -10.50   -4.12    2.34    8.75   -0.12  -10.50
SO XBADJ    STACK2    -20.25  -29.75  -38.25 -307.75 -313.00 -308.50
SO XBADJ    STACK2    -73.00  -62.75  -66.50  -67.50  -67.00  -64.00
SO XBADJ    STACK2    -59.38  -52.88  -44.66  -35.19  -39.75  -44.50
SO XBADJ    STACK2    -47.50  -49.25  -49.50  -48.00  -45.25  -41.00
SO YBADJ    STACK2    -17.03  -19.81  -17.00  -13.75   -9.75   -5.62
SO YBADJ    STACK2     -1.38    2.88    7.25   11.25   14.25   17.62
SO YBADJ    STACK2     20.38   22.38   23.88   27.44  -16.00  -55.09
SO YBADJ    STACK2     16.97   19.88   17.12   13.50    9.75    5.62
SO YBADJ    STACK2      1.38   -3.00   -7.50  -11.25  -14.25  -17.75
SO YBADJ    STACK2    -20.50  -22.62  -23.88  -24.44  -24.31  -23.53
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SO BUILDHGT STACK3     35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT STACK3     35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT STACK3     35.29   35.29   39.60   39.60   39.60   39.60
SO BUILDHGT STACK3     35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT STACK3     35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT STACK3     35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDWID STACK3     36.38   39.88   54.75   68.00   79.00   87.75
SO BUILDWID STACK3     93.75   96.75   97.50   94.50   97.00   97.25
SO BUILDWID STACK3     94.25   88.75   94.50   86.12   87.75   95.56
SO BUILDWID STACK3     36.38   40.00   54.75   68.00   79.00   87.75
SO BUILDWID STACK3     93.75   97.00   97.00   94.50   97.00   97.00
SO BUILDWID STACK3     94.50   88.75   80.75   69.88   56.88   42.31
SO BUILDLEN STACK3    109.50   97.00   97.25   94.50   88.75   80.50
SO BUILDLEN STACK3     69.88   57.00   42.31   26.44   39.88   54.75
SO BUILDLEN STACK3     67.75   79.00  118.50  121.75  121.50  117.50
SO BUILDLEN STACK3    109.00   97.00   97.25   94.50   88.75   80.50
SO BUILDLEN STACK3     69.88   57.00   42.31   26.44   39.88   54.75
SO BUILDLEN STACK3     67.75   78.75   87.75   93.50   96.75   97.00
SO XBADJ    STACK3    -59.00  -56.50  -52.50  -46.75  -39.50  -31.25
SO XBADJ    STACK3    -22.00  -12.00   -1.72    8.66    3.75   -2.75
SO XBADJ    STACK3     -9.00  -15.00 -276.00 -288.00 -291.50 -286.00
SO XBADJ    STACK3    -50.00  -40.25  -45.00  -47.75  -49.25  -49.25
SO XBADJ    STACK3    -47.88  -45.00  -40.59  -35.09  -43.62  -52.12
SO XBADJ    STACK3    -58.75  -63.75  -67.00  -67.75  -66.75  -63.50
SO YBADJ    STACK3    -16.94  -23.69  -24.75  -25.00  -24.25  -23.12
SO YBADJ    STACK3    -21.12  -18.38  -15.25  -11.75   -8.25   -3.88
SO YBADJ    STACK3      0.62    4.88   59.25   15.94  -23.88  -59.16
SO YBADJ    STACK3     16.88   23.75   24.88   24.75   24.25   23.12
SO YBADJ    STACK3     21.12   18.50   15.00   11.75    8.25    3.75
SO YBADJ    STACK3     -0.75   -4.88   -9.12  -12.94  -16.44  -19.47

SO BUILDHGT STACK4     35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT STACK4     35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT STACK4     35.29   35.29   39.60   39.60   39.60   39.60
SO BUILDHGT STACK4     35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT STACK4     35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT STACK4     35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDWID STACK4     36.38   39.88   54.75   68.00   79.00   87.75
SO BUILDWID STACK4     93.75   96.75   97.50   94.50   97.00   97.25
SO BUILDWID STACK4     94.25   88.75   94.50   86.12   87.75   95.56
SO BUILDWID STACK4     36.38   40.00   54.75   68.00   79.00   87.75
SO BUILDWID STACK4     93.75   97.00   97.00   94.50   97.00   97.00
SO BUILDWID STACK4     94.50   88.75   80.75   69.88   56.88   42.31
SO BUILDLEN STACK4    109.50   97.00   97.25   94.50   88.75   80.50
SO BUILDLEN STACK4     69.88   57.00   42.31   26.44   39.88   54.75
SO BUILDLEN STACK4     67.75   79.00  118.50  121.75  121.50  117.50
SO BUILDLEN STACK4    109.00   97.00   97.25   94.50   88.75   80.50
SO BUILDLEN STACK4     69.88   57.00   42.31   26.44   39.88   54.75
SO BUILDLEN STACK4     67.75   78.75   87.75   93.50   96.75   97.00
SO XBADJ    STACK4    -82.50  -80.00  -75.00  -67.75  -58.25  -47.25
SO XBADJ    STACK4    -34.75  -21.12   -6.84    7.59    6.88    4.38
SO XBADJ    STACK4      2.00   -0.75 -258.50 -268.25 -269.75 -263.00
SO XBADJ    STACK4    -26.50  -17.00  -22.50  -26.75  -30.75  -33.25
SO XBADJ    STACK4    -35.12  -35.88  -35.47  -34.06  -46.75  -59.25
SO XBADJ    STACK4    -69.75  -78.25  -84.25  -87.75  -88.50  -86.50
SO YBADJ    STACK4    -15.91  -26.69  -31.75  -35.75  -38.75  -40.62
SO YBADJ    STACK4    -41.12  -40.12  -38.25  -35.25  -31.50  -26.38
SO YBADJ    STACK4    -20.38  -13.88   43.25    3.19  -32.88  -64.28
SO YBADJ    STACK4     15.81   26.88   31.88   35.75   38.75   40.38
SO YBADJ    STACK4     40.88   40.25   38.00   35.25   31.50   26.25
SO YBADJ    STACK4     20.25   13.62    6.88   -0.19   -7.31  -14.34

SO BUILDHGT STACK5     35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT STACK5     35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT STACK5     35.29   39.60   39.60   39.60   39.60   35.29
SO BUILDHGT STACK5     35.29   35.29   35.29   35.29   35.29   35.29
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SO	BUILDHGT	STACK5	35.29	35.29	35.29	35.29	35.29	35.29
SO	BUILDHGT	STACK5	35.29	35.29	35.29	35.29	35.29	35.29
SO	BUILDWID	STACK5	36.38	39.88	54.75	68.00	79.00	87.75
SO	BUILDWID	STACK5	93.75	96.75	97.50	94.50	97.00	97.25
SO	BUILDWID	STACK5	94.25	99.75	94.50	86.12	87.75	42.34
SO	BUILDWID	STACK5	36.38	40.00	54.75	68.00	79.00	87.75
SO	BUILDWID	STACK5	93.75	97.00	97.00	94.50	97.00	97.00
SO	BUILDWID	STACK5	94.50	88.75	80.75	69.88	56.88	42.31
SO	BUILDLEN	STACK5	109.50	97.00	97.25	94.50	88.75	80.50
SO	BUILDLEN	STACK5	69.88	57.00	42.31	26.44	39.88	54.75
SO	BUILDLEN	STACK5	67.75	111.50	118.50	121.75	121.50	97.00
SO	BUILDLEN	STACK5	109.00	97.00	97.25	94.50	88.75	80.50
SO	BUILDLEN	STACK5	69.88	57.00	42.31	26.44	39.88	54.75
SO	BUILDLEN	STACK5	67.75	78.75	87.75	93.50	96.75	97.00
SO	XBADJ	STACK5	-107.00	-104.00	-98.00	-89.00	-77.25	-63.25
SO	XBADJ	STACK5	-47.12	-29.75	-11.34	7.31	10.75	12.38
SO	XBADJ	STACK5	14.00	-225.25	-240.00	-247.25	-247.00	13.50
SO	XBADJ	STACK5	-2.00	7.25	0.75	-5.50	-11.75	-17.50
SO	XBADJ	STACK5	-22.75	-27.38	-30.97	-33.78	-50.75	-67.38
SO	XBADJ	STACK5	-81.75	-93.75	-103.00	-108.75	-111.25	-110.50
SO	YBADJ	STACK5	-15.62	-30.69	-39.88	-47.75	-54.25	-59.12
SO	YBADJ	STACK5	-62.12	-63.12	-62.25	-59.75	-55.50	-49.38
SO	YBADJ	STACK5	-41.62	62.88	27.25	-9.19	-41.50	9.83
SO	YBADJ	STACK5	15.56	30.75	40.00	47.75	54.00	58.88
SO	YBADJ	STACK5	61.88	63.00	62.00	59.25	55.75	49.25
SO	YBADJ	STACK5	41.50	32.62	22.88	12.19	1.19	-9.84
SO	BUILDHGT	SILO1	35.29	35.29	35.29	35.29	30.71	30.71
SO	BUILDHGT	SILO1	30.71	30.71	30.71	30.71	30.71	30.71
SO	BUILDHGT	SILO1	35.29	35.29	35.29	35.29	35.29	35.29
SO	BUILDHGT	SILO1	35.29	35.29	35.29	35.29	30.71	30.71
SO	BUILDHGT	SILO1	30.71	30.71	30.71	30.71	30.71	30.71
SO	BUILDHGT	SILO1	35.29	35.29	35.29	35.29	35.29	35.29
SO	BUILDWID	SILO1	36.38	39.88	54.75	68.00	19.75	17.25
SO	BUILDWID	SILO1	14.75	16.00	18.50	20.50	23.00	24.75
SO	BUILDWID	SILO1	155.00	150.25	140.75	127.50	64.00	42.34
SO	BUILDWID	SILO1	36.38	40.00	54.75	68.00	19.75	17.25
SO	BUILDWID	SILO1	14.75	15.75	18.50	20.50	23.00	25.00
SO	BUILDWID	SILO1	155.00	150.25	140.75	127.38	64.00	42.31
SO	BUILDLEN	SILO1	109.50	97.00	97.25	94.50	27.75	28.50
SO	BUILDLEN	SILO1	28.88	28.75	28.22	27.16	25.88	24.00
SO	BUILDLEN	SILO1	131.75	148.25	160.25	167.25	97.00	97.00
SO	BUILDLEN	SILO1	109.00	97.00	97.25	94.50	27.75	28.50
SO	BUILDLEN	SILO1	28.88	28.75	28.22	27.12	25.88	24.12
SO	BUILDLEN	SILO1	131.50	148.25	160.25	167.50	96.75	97.00
SO	XBADJ	SILO1	63.50	61.50	58.00	52.75	-7.00	-7.00
SO	XBADJ	SILO1	-6.88	-6.75	-6.72	-6.62	-6.62	-6.62
SO	XBADJ	SILO1	-156.50	-178.50	-195.50	-206.25	-149.25	-156.00
SO	XBADJ	SILO1	-172.00	-158.50	-155.25	-147.25	-20.75	-21.75
SO	XBADJ	SILO1	-22.00	-22.00	-21.50	-20.53	-19.25	-17.62
SO	XBADJ	SILO1	25.00	30.25	35.00	38.75	52.25	59.00
SO	YBADJ	SILO1	-4.31	9.94	28.88	47.00	-3.38	-2.12
SO	YBADJ	SILO1	-0.88	0.50	1.75	3.25	4.25	5.38
SO	YBADJ	SILO1	82.00	65.12	46.88	27.00	42.88	28.23
SO	YBADJ	SILO1	4.25	-9.88	-28.88	-47.25	3.38	2.12
SO	YBADJ	SILO1	0.88	-0.62	-2.25	-3.25	-4.25	-5.50
SO	YBADJ	SILO1	-82.00	-65.38	-46.88	-26.94	-42.75	-28.25
SO	BUILDHGT	SILO2	35.29	35.29	35.29	30.71	30.71	30.71
SO	BUILDHGT	SILO2	30.71	30.71	30.71	30.71	30.71	35.29
SO	BUILDHGT	SILO2	35.29	35.29	35.29	35.29	35.29	35.29
SO	BUILDHGT	SILO2	35.29	35.29	35.29	30.71	30.71	30.71
SO	BUILDHGT	SILO2	30.71	30.71	30.71	30.71	30.71	35.29
SO	BUILDHGT	SILO2	35.29	35.29	35.29	35.29	35.29	35.29
SO	BUILDWID	SILO2	36.38	39.88	54.75	22.00	19.75	17.25
SO	BUILDWID	SILO2	14.75	16.00	18.50	20.50	23.00	154.75

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SO BUILDWID SILO2     155.00  150.25  140.75   69.75   56.88   42.34
SO BUILDWID SILO2      36.38   40.00   54.75   22.25   19.75   17.25
SO BUILDWID SILO2      14.75   15.75   18.50   20.50   23.00  155.00
SO BUILDWID SILO2     155.00  150.25  140.75   69.88   56.88   42.31
SO BUILDLEN SILO2     109.50   97.00   97.25   26.50   27.75   28.50
SO BUILDLEN SILO2      28.88   28.75   28.22   27.16   25.88  111.12
SO BUILDLEN SILO2     131.75  148.25  160.25   93.75   97.00   97.00
SO BUILDLEN SILO2     109.00   97.00   97.25   26.50   27.75   28.50
SO BUILDLEN SILO2      28.88   28.75   28.22   27.12   25.88  111.12
SO BUILDLEN SILO2     131.50  148.25  160.25   93.50   96.75   97.00
SO XBADJ    SILO2      56.50   52.50   47.00  -19.75  -21.00  -21.50
SO XBADJ    SILO2     -21.75  -21.50  -20.94  -19.84  -18.50 -139.75
SO XBADJ    SILO2    -164.50 -184.25 -198.50 -138.50 -147.25 -151.50
SO XBADJ    SILO2    -165.50 -149.25 -144.25   -6.75   -7.00   -7.00
SO XBADJ    SILO2      -7.12   -7.25   -7.28   -7.31   -7.50   28.38
SO XBADJ    SILO2      33.00   36.00   38.25   45.00   50.50   54.50
SO YBADJ    SILO2       8.91   21.81   39.00    3.50    2.38    0.88
SO YBADJ    SILO2      -0.12   -1.50   -2.75   -3.75   -5.00   84.88
SO YBADJ    SILO2      69.25   51.38   32.38   48.25   31.56   14.02
SO YBADJ    SILO2      -8.97  -21.75  -38.88   -3.62   -2.12   -1.12
SO YBADJ    SILO2       0.12    1.38    2.25    3.75    5.00  -84.75
SO YBADJ    SILO2     -69.25  -51.62  -32.38  -48.19  -31.56  -14.03

SO BUILDHGT SILO3      35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT SILO3      35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT SILO3      35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT SILO3      35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT SILO3      35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDHGT SILO3      35.29   35.29   35.29   35.29   35.29   35.29
SO BUILDWID SILO3      36.38   39.88   54.75   68.00   79.00   87.75
SO BUILDWID SILO3      93.75   96.75  166.50  158.50  156.25  154.75
SO BUILDWID SILO3     155.00  150.25  140.75  127.50   64.00   43.31
SO BUILDWID SILO3      36.38   40.00   54.75   68.00   79.00   87.75
SO BUILDWID SILO3      93.75   97.00  166.50  158.00  156.50  155.00
SO BUILDWID SILO3     155.00  150.25  140.75  127.38   64.00   43.31
SO BUILDLEN SILO3     109.50   97.00   97.25   94.50   88.75   80.50
SO BUILDLEN SILO3      69.88   57.00   89.22   65.75   87.25  111.12
SO BUILDLEN SILO3     131.75  148.25  160.25  167.25   97.00   97.00
SO BUILDLEN SILO3     109.00   97.00   97.25   94.50   88.75   80.50
SO BUILDLEN SILO3      69.88   57.00   89.22   65.72   87.25  111.12
SO BUILDLEN SILO3     131.50  148.25  160.25  167.50   96.75   97.00
SO XBADJ    SILO3      31.50   33.00   33.75   33.50   32.50   30.00
SO XBADJ    SILO3      27.00   23.00  -47.94  -50.88  -76.25 -102.50
SO XBADJ    SILO3    -125.50 -144.75 -159.75 -169.75 -113.25 -121.50
SO XBADJ    SILO3    -140.00 -130.00 -131.25 -128.00 -121.25 -110.75
SO XBADJ    SILO3     -96.88  -80.00  -41.28  -14.91  -11.00   -8.75
SO XBADJ    SILO3      -6.00   -3.50   -0.50    2.50   16.50   24.50
SO YBADJ    SILO3     -21.50  -12.44    1.88   16.25   30.00   42.88
SO YBADJ    SILO3      54.62   64.62   91.25   89.75   80.88   71.62
SO YBADJ    SILO3      62.75   51.88   39.38   25.88   48.00   39.09
SO YBADJ    SILO3      21.41   12.62   -1.75  -16.25  -30.25  -43.12
SO YBADJ    SILO3     -54.62  -64.75  -91.25  -89.50  -80.75  -71.75
SO YBADJ    SILO3     -62.75  -51.88  -39.38  -25.81  -48.00  -39.09
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